

# 2019 CRP Annual Reporting

## CGIAR Research Program on Livestock Agri-Food Systems (CRP LIVESTOCK)

Name of Lead Centre: International Livestock Research Institute (ILRI)

Flagship lead institutions (CGIAR Centres or lead partners):

- Flagship 1: Livestock Genetics - ILRI
- Flagship 2: Livestock Health - Swedish University for Agricultural Sciences (SLU)
- Flagship 3: Livestock Feeds and Forages - International Centre for Tropical Agriculture (CIAT)
- Flagship 4: Livestock and the Environment - ILRI
- Flagship 5: Livestock Livelihoods and Agri-Food Systems - ILRI

Other participating CGIAR Centres:

- International Centre for Agricultural Research in the Dry Areas (ICARDA)

CGIAR is a global partnership that unites organizations engaged in research for a food-secure future. The CGIAR Research Program on Livestock provides research-based solutions to help smallholder farmers, pastoralists and agro-pastoralists transition to sustainable, resilient livelihoods and to productive enterprises that will help feed future generations. It aims to increase the productivity of livestock agri-food systems in sustainable ways, making meat, milk and eggs more available and affordable across the developing world. The Program brings together five core partners: the International Livestock Research Institute (ILRI) with a mandate on livestock; the International Center for Tropical Agriculture (CIAT), which works on forages; the International Center for Research in the Dry Areas (ICARDA), which works on small ruminants and dryland systems; the Swedish University of Agricultural Sciences (SLU) with expertise particularly in animal health and genetics and the Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) which connects research into development and innovation and scaling processes.


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## EXECUTIVE SUMMARY

At midpoint in the current CRP cycle, the program advanced its research agenda across the flagships as planned. Long-term work on improving livestock genetics saw big payoffs in 2019, with more productive, locally adapted breeds of poultry, cattle and small ruminants being taken to scale in Africa. Proposals were finalized for 4 priority country projects, which commenced implementation of activities combining research inputs from all 5 flagships to pilot integrated interventions.

**Livestock Genetics FP1** focuses on implementation of genetic improvement programs and associated delivery systems to ensure that smallholder farmers utilize appropriate livestock breeds. Highlights included: influencing Tanzania's national artificial insemination centre to adopt genetically superior crossbreed dairy cattle; upscaling of community based breeding programs (CBBPs) in several African countries; contributing training material on CBBPs for incorporation in the curricula of Ethiopian national universities in Ethiopia; and influencing private poultry companies in three countries to adopt more productive and resilient chicken breeds for delivery to smallholder farmers.

**Livestock Health FP2** identifies animal disease risks, then develops and tests methods and delivery approaches to mitigate these risks through herd health management, diagnostics and vaccine innovations. Key achievements included development and pretesting of a gender sensitive *peste des petits ruminants* toolbox, piloting of community conversation trainings on animal welfare and antimicrobial use in Ethiopia, development of an improved ELISA (enzyme-linked immunosorbent assay) for contagious bovine pleuropneumonia infection and the construction of gene deleted African swine fever virus strains for testing as vaccine candidates.

**Feeds and Forages FP3** made significant advances on developing (barley, *Urochloa*, *Megathyrsus*, Napier) and scaling out (cactus and dual purpose maize in India, barley in Northern Africa, *Urochloa* hybrids in Latin America/Caribbean and East Africa) forage technologies and disseminating decision support tools. Progress was also made on developing and testing business models for Feeds and Forages in North and East Africa and Latin America.

**Livestock and the Environment FP4** addresses greenhouse gas emissions and adaptation to climate change. The flagship issued guidance for researchers on engaging policy makers in improving greenhouse gas emissions data, piloted feed interventions to reduce emissions in smallholder dairy systems across Tanzania, Rwanda, Kenya and Ethiopia, and conducted trainings on the Rural Household Multi Indicator Survey (RHoMIS) tool, which enables evaluation of tradeoffs between household food security, production and environmental objectives.

**Livestock Livelihoods and Agri-Food Systems FP5** ensures that CRP technologies/strategies achieve positive impacts on the resource poor. Achievements included use of the Women Empowerment in Livestock Index, and international engagement on the dietary importance of animal source foods, including challenging blanket recommendations to reduce their consumption (information provided by FP5 was quoted in a press release by The Permanent Mission of Italy to the International Organizations in Geneva). A journal article in *Frontiers in Sustainable Food Systems* on food access deficiencies in sub-Saharan Africa and implications for agricultural interventions is in the top 5% of all research outputs.

## Part A: NARRATIVE SECTION

### 1. Key Results

#### 1.1 Progress Towards SDGs and SLOs (sphere of interest, with research results frequently predating the CRP)

In 2019, **Feeds and Forages FP3** continued to make good progress on scaling out *Urochloa* hybrids through its private sector partner, Papalotla. Based on seed sales, the total area sown with CIAT hybrids is estimated at 1 million hectares in over 30 countries at the end of 2019 (data for this will be available in mid-2020). To date, there has not been any research into the condition of the pastures or success in establishment, but close interaction with Papalotla indicates that success rates are quite high. No rigorous adoption studies or impact assessments were planned or carried out by the CRP Livestock in 2019, thus there is very limited evidence of any additional contributions towards the CGIAR Strategic Results Framework targets.

#### 1.2 CRP Progress towards Outputs and Outcomes (spheres of control and influence)

##### 1.2.1 Overall CRP progress

At midpoint in the current CRP cycle, the program advanced its research agenda across the flagships as planned, with notable achievements and only minor adjustments within specific activities. Long-term work on improving livestock genetics saw big payoffs in 2019, taking major achievements to scale in Africa. Chicken breeds selected for productivity and resilience were taken up by private sector partners in Ethiopia, Nigeria and Tanzania, high performing locally adapted bulls were identified and adopted for the first time by Tanzania's national artificial insemination program for use by farmers, and the community-based breeding model for small ruminants was scaled up in new African countries. Other key highlights include two African swine fever vaccine candidates identified, three new dual-purpose barley varieties released, improved governance of rangelands to reduce degradation adopted by government agencies in four countries, and wider uptake of the Women's Empowerment in Livestock beyond the CRP. 2019 also saw all five flagships join forces to initiate the design and pilot testing of integrated interventions with national partners, to transform selected livestock value chains and systems in the four priority countries of Ethiopia, Tanzania, Uganda and Vietnam as a model for end-to-end delivery. Overall, flagships successfully completed 35 (66%) of their 2019 milestones, plus 5 of 12 extended from 2018, with 3 milestones cancelled due to unrealized funding or adjusted priorities. Remaining milestones faced challenges of delayed funding or other implementation issues but have advanced well and most are expected to be completed in 2020.

##### 1.2.2 Progress by flagships

###### FP1 - Livestock Genetics:

The flagship reported 4 policies, 8 innovations and 2 completed milestones. Key achievements included Community Based Breeding Programs (CBBPs) for small ruminants being upscaled in a number of African countries (OICR 3269), supported by a framework for the upscaling (a flagship innovation), and training on CBBPs being incorporated in the curriculum of national universities (OICR 3271, also a policy). The dairy cattle breeding program influenced, through the provision of evidence, the national artificial insemination centre of Tanzania to adopt a new, genetically superior, crossbreed of cattle (OICR 3272). This breeding program also generated two innovations: a digital tool for interaction with farmers, and a protocol and pipeline for use of genomic information in the breeding program. In relation to poultry genetic improvement, generated evidence influenced private companies in three countries to deliver more productive and resilient chicken breeds (OICR 3297, also a policy). Milestones completed included the establishment of a network of reproductive laboratories for small ruminants in Ethiopia and Tanzania (1.3), and the establishment of smallholder poultry platforms in Ethiopia, Nigeria and Tanzania (1.5). Four other milestones were extended (as they are still in pilot phase) and 1 cancelled (no resources).

### FP2 - Livestock Health:

The flagship completed 10/15 milestones for 2019 plus one extended from 2018 and reported 2 policies and 11 innovations. Achievements included analysis of existing statutes that showed that the private sector is legally allowed to deliver livestock vaccines in Kenya, establishment of innovation platforms in Mali that are ready for uptake, and successful piloting of community conversation trainings on animal welfare and antimicrobials in Ethiopia. Other accomplishments were the development and pretesting of a gender sensitive *peste des petits ruminants*-toolbox, with data collection initiated in five countries (2.1). The W1/W2 funded longitudinal work in pig herds disclosed new health/production challenges, helping devise a framework to conduct farm assessments (2.2). With same funding, the Flagships' collection tool on knowledge, attitudes and practices on use of antimicrobials (2.3) was applied and rolled out in several countries. Diagnostic and vaccine highlights (2.4) were the development of an improved ELISA for contagious bovine pleuropneumonia infection that is now with private partners for prototype improvement, decision on commercialization and the construction of gene deleted African Swine Fever Virus strains ready for testing as vaccine candidates. The flagship contributed to the creation of regional public-private partnership task forces on animal health services (2.5) in Ethiopia.

### FP3 - Feeds and Forages:

The Flagship completed 13/14 milestones, plus one extended 2018 milestone, and reported 1 OICR and 13 innovations. To strengthen feed/forage prioritization (3.1), the flagship tested/applied the genderized Feed Assessment Tool (G-FEAST) in Burkina Faso, Uganda and Vietnam, launched the VegMeasure tool (for accurate measurement of vegetation on rangelands/forests) and developed forage near infra-red spectroscopy (NIRS) equations/facilities. To promote improved forages (3.3), global private sector commercialization of existing *Urochloa* hybrids was increased, new generations of *Megathyrus/Urochloa* targeting specific production niches in Latin America/Caribbean and East Africa (LAC/EA) developed, 3 new barley hybrids released (India/Jordan), and candidate genes associated with Napier forage traits identified. To promote uptake of dual-purpose crop cultivars (3.4), dual-purpose maize hybrids were disseminated on 100,000 hectares (India). For better utilization of feed/forage resources (3.5), feed processing options were adopted by public/private sector (India), and mobile seed cleaning/treatment units and fodder grinders were developed (Tunisia). Regarding rangeland/pasture management (3.6), 1,200 Indian farmers adopted cactus as an alternative fodder crop. On uptake of feed/forage resources (3.8), forage cost-benefit analyses were conducted in LAC/EA, and new business models developed for pellet/mash (Tunisia), forages as cash crop (India) and Kenya (hay). Forage extension approaches were tested (Tunisia, Colombia) and training materials developed.

### FP4 - Livestock and the Environment:

The flagship completed 13/14 milestones plus one extended from 2018, and reported 4 policies and 6 innovations. On outcome 4.1, heat stress mapping was expanded to include dairy systems and the analysis of environmental co-benefits and tradeoffs of dairy intensification through improved forages. Regarding outcome 4.2 to help partners consider environmental outcomes in decision making, the flagship completed greenhouse gas baselines for new dairy systems in Tanzania. The Comprehensive Livestock Environmental Assessment for improved Nutrition, a secured Environment and sustainable Development along livestock value chains (CLEANED) tool was expanded to include pig and silvopastoral systems. For milestone 3, to help national partners promote environmental management options, advances were made for including soil organic carbon in greenhouse gas emissions assessments and feed interventions to reduce greenhouse gas emissions (and measure this impact) were piloted in smallholder dairy systems across Tanzania, Rwanda, Kenya and Ethiopia. For outcome 4.4, a review of best practice on gender inclusion in sustainable land management was published. For outcome 4.5, the flagship noted that government agencies in four countries are improving land governance arrangements to reduce degradation in rangelands. Finally, policy guidelines on improving greenhouse gas emissions data in support of outcome 4.6 were issued.

### FP5 - Livestock Livelihoods and Agri-Food Systems:

The flagship completed 2/7 milestones plus one extended from 2018, making important progress towards 5 additional milestones that were extended to 2020 due to time-consuming resource mobilization efforts. Three policies were reported and the flagship delivered 5 innovations. For outcome 5.1, achievements included progress on various modelling frameworks, at value chain, country and global levels, including adaptation of the Livestock Sector Investment and Policy Toolkit (LSIPT) in three agro-ecological zones of Egypt. The team continued engaging its networks of decision makers at local levels through on-the-ground work with development partners, at national levels through engagement on livestock master plans (although no new ones were started in 2019) and at regional levels (Comprehensive Africa Agriculture Development Programme). For outcomes 5.3 and 5.4, the Women's Empowerment in Livestock Index was published (methodology and application) and 3 bilateral projects adopted it as a monitoring tool. Field research on gender transformative approaches commenced under two new grants, while the team continued to embed gender work in technical teams of the other flagships. Regarding outcomes 5.6 and 5.7, work on integrated technologies, practices and institutions for improved livestock systems progressed through on-the-ground work with development agents and private sector, in Ethiopia, Kenya and Myanmar.

### 1.2.3 Variance from Planned Program for this year

#### A) Have any promising research areas been significantly expanded?

Under **FP1 Livestock Genetics**, based on requests from national partners, the small ruminant reproductive platform was expanded into more sites in Ethiopia, funded by flagship W1/2 funds, a bilateral project, and partner contributions. Under **FP2 Livestock Health**, research on alternative delivery models to facilitate access to animal health services in Ethiopia and Kenya was significantly expanded with two new bilateral projects focused on strengthening private sector involvement. Also, the flagship conducted research on two zoonotic tick-borne diseases representing a major global public health threat, Crimean-Congo haemorrhagic fever in dromedaries and tick-borne encephalitis in sheep. While **FP3 Feeds and Forages** did not make any major adjustments or expansions, more attention was dedicated to gender work and to influencing policies through closer engagement with policy processes (e.g. round tables). **FP4 Livestock and the Environment** consolidated research from three CGIAR partners on soil carbon in rangelands, silvopastoral and mixed crop-livestock systems, to understand its role in greenhouse gas emissions in those systems. This is supported by bilateral projects with W 1/2 and allows for higher-level synthesis. **FP5 Livestock Livelihoods and Agri-Food Systems** conducted scaling readiness assessments in Tanzania and Uganda under the priority country projects.

#### B) Have any research lines been dropped or significantly cut back?

Moving forward, **FP1 Livestock Genetics** will place less emphasis on activities supporting outcome 1.5 (policies and institutional arrangements supporting animal genetic resource use), due to the generally favourable institutional and policy environments for animal genetic resource use in the Flagship target countries. Under **FP2 Livestock Health**, joint desktop work between ICARDA and ILRI on alternative methods for the control of ticks was dropped due to lack of funds and difficulty in identifying the appropriate individual to undertake the task.

#### C) Have any flagships or specific research areas changed direction?

Work on antimicrobial resistance under **FP2 Livestock Health** is now focused on the use of antimicrobials, with limited recording of antimicrobial resistance. This is because the flagship has a comparative advantage in analyzing the use of antibiotics, how use patterns among farmers can change and the role of improved animal health and husbandry. Other actors are equally as capable of monitoring antimicrobial resistance and are already doing so. **FP5 Livestock Livelihoods and Agri-Food Systems** decided to work on a paper on youth using existing data available at ILRI, rather than trying to raise funds for additional work.

### 1.2.4 Altmetric and Publication highlights

As per Altmetric scores, the top 20 research outputs in 2019 represented work across all 5 CRP flagships and included 17 peer-reviewed journal articles, one toolkit manual, one research report and one project brochure. The top article was about food access deficiencies in sub-Saharan Africa and the implications for agricultural interventions (**FP5**), published in *Frontiers in Sustainable Food Systems*. With an Altmetric Attention Score of 151, this journal article is in the top 5% of all research outputs and the 98th percentile compared to other outputs of the same age. It was mentioned by 4 news outlets, in 4 blogs and by 122 twitter users and read by 32 people on Mendeley. The second article, published in *Global Food Security* and with an Altmetric Attention Score of 96 (97th percentile), was about scenario analysis of investment options for sustainable expansion of livestock (**FP4**). This paper was mentioned in 8 blogs, tweeted 81 times and read by 56 Mendeley users. The third article, published in *BMC Genomics* and with a score of 82 (97th percentile), concerned genetics of forage breeding (*Brachiaria humidicola*, **FP3**), which was mentioned by 7 news outlets, 1 blogger and 33 twitter users. The fourth highest article was on experiences and drivers of food insecurity in Guatemala (**FP4**), published in *Frontiers in Sustainable Food Systems*. It had a score of 40 (94th percentile) and was mentioned by 3 news outlets, one blogger and 16 tweeters. The fifth article, published in *Vaccine* and with a score of 36 (93rd percentile), concerned a randomized vaccine field trial for protection against malignant catarrhal fever in cattle in Kenya (**FP2**). The paper garnered one news mention and 2 blogs and was tweeted 21 times. The highest ranked output from **FP1** was the peer-reviewed journal article ranking fifteenth overall for the CRP, on phenotypic distribution models to predict livestock performance, published in *Scientific Reports* and with a score of 21 (89th percentile).

## 1.3 Cross-cutting dimensions (at CRP level)

### 1.3.1 Gender

#### A) List any important CRP research findings

Gender research within the CRP Livestock was able to thrive in 2019. It continued to grow both in breadth and in depth. Gender research within the CRP Livestock was able to thrive in 2019. It continued to grow both in breadth and in depth. Gender work in the flagships was consolidated through the allocation of dedicated gender researchers: 30% staff time in **FP1 Livestock Health**, 50% staff time in **FP3 Feeds and Forages** (a full-time staff member shared with CCAFS), and a full-time staff member in **FP4 Livestock and the Environment**. This led to a series of gender research highlights including:

- The use of the Women's Empowerment in Livestock Index (WELI) in 4 projects. This will result in a larger WELI database and the ability to compare data across 6 countries (Nepal, Senegal, Uganda, Ethiopia, Kenya, Ghana and Tanzania).
- Understanding the role of gender in large scale projects such as the World Bank (WB) Regional Sahel Pastoralism Support Project, which is dedicated to animal health, and where setting up sustainable gender interventions requires clear financial and senior management support. This came out of a collaboration with the WB gender team conducting a mid-term gender review.
- Adequately ensuring the participation of women helps to bridge the gaps hindering their access to assets, services, and information that are key to technology adoption. For example, expanding forage production by women is often constrained by their long-term ability to access land, so they need to be included in developing solutions.
- Increasing gender investments in livestock at a national level requires a new approach to gender that integrates women into the planning, as most investments are based on herd models. This was a clear finding of recent work in Bihar, India where gender was integrated into the Livestock Master Plan.

Other highlights on gender in 2019 were:

- Being invited to give a keynote speaker at the International Veterinary Vaccination Network in London. This provided an opportunity to discuss issues of gender within vaccines to a wide audience, with the idea that getting vaccines into the hands of women can change animal health at household level.

- The contribution of the gender team to the new GENDER platform proposal for the CGIAR, which was subsequently approved and which ILRI now hosts.
- The contribution of 3 ILRI gender scientists to the CGIAR gender book.
- The initiation of a paper among several centers (CIMMYT and ICARDA) to look at livestock within the GENNOVATE (cross-CRP, global comparative research initiative addressing the question of how gender norms and agency Influence men, women, and youth to adopt innovation in agriculture and natural resource management) database.
- The collaboration with new partners such as Stanford's Global Center for Gender Equality.

### **B) What have you learned? What are you doing differently?**

Due to increased interest in and understanding of gender issues, the need for gender mainstreaming has changed. In the past, it was often not clear where the gender entry points were in a project, which meant that a gender researcher would have to do a gender analysis and accompany the technical scientists in developing the gender research question. Now the approach is more to target the work in certain areas within the CRP where gender dynamics are prominent and where the work has a potential to impact gender inequities.

Another area that has evolved over the past year is the ability to ensure direct funding for gender work. Certain funders are supporting this and across different CGIAR centres this is also becoming a reality. This has meant that the gender work can lead in certain areas, and not be solely dependent on the work identified in the flagships.

### **C) Have any problems arisen in relation to gender issues or integrating gender into the CRP's research?**

The lack of human resources (i.e. gender researchers) has been the most common reason linked to the gender team's limitations in supporting certain work in some flagships. This was especially true within **FP2 Livestock Health** (although one of the scientists does a lot of gender-related work), **FP3 Feeds and Forages** and the priority country programs. This is partly a budgeting issue, where willingness to support gender outputs is not always linked to staff time or in some cases where funding was allocated to gender issues, the amount was not enough to hire full-time staff.

### **1.3.2 Youth and other aspects of Social inclusion / "Leaving No-one Behind"**

In 2019, Livestock CRP research included work that focused on various 'left behind' populations, which include youth, small and middle scale livestock keepers and other actors, and communities in pastoral areas (who are often absent from decision and policy making). A [paper](#) was published on intersectionality in agriculture research for development, that examined groups 'beyond women and youth'. **FP3 Feeds and Forages** established a new [partnership](#) with one of the largest dairy companies in Colombia to support their youth-centered education program of dairy producers with specific technical and social components in 2020. In Ethiopia, ICARDA in partnership with the National Research Centers and the national extension have trained youth as disseminators of improved sheep fattening technologies and practices in the Ethiopian highlands: 485 youth in 75 villages were organized into 44 youth groups to serve as benchmark sites for sheep farming communities to adopt improved sheep fattening practices and undertake sheep fattening as a business. To ensure sustainability of the entrepreneurial culture, community of practice teams in target sites were formed and strengthened with knowledge and skills to enable them to garner support from regional and local administrative offices to create an enabling environment for commercialized sheep fattening. **FP4 Livestock and the Environment**, working with CCAFS, conducted research on how to more effectively include youth in dairy value chains, paying particular attention to how interventions to make these value chains more "low emissions" might affect youth. The same approach will be followed under the Livestock CRP in the priority country programme of Tanzania. Based on the CRP youth strategy, **FP5 Livestock Livelihoods and Agri-Food Systems** embarked on compiling existing data and information from projects, with the objective to assess the participation of youth in projects and livestock value chains.

**A) List any important CRP research findings**

One research finding, while not a new one, relates to the ages of livestock-keeping populations. An analysis of existing data will shed more light on this point, but it is clear that differences in capabilities, incentives and aspirations between generations need to be taken into account for future research and scaling activities.

In Ethiopia, a combination of technical and entrepreneurial trainings provided under **FP3 Feeds and Forages** and **FP5 Livestock Livelihoods and Agri-Food Systems** has proved effective and has led to a marked favourable shift in mindset and attitude towards commercialized sheep fattening. 85% of the youth participants have increased fattening ram numbers per cycle from 0-1 to more than 6 fattening rams within a period of 1.5 years. 90% are undertaking 3-4 fattening cycles per annum, with average daily gains of rams increasing between 40-67% as a result of improved fattening practices and gains in selling price of rams between 45-70%.

**B) What have you learned? What are you doing differently?**

As no additional funds were raised for youth work, the CRP decided to re-analyze existing data, looking at participation of youth in livestock value chains. Where data were sufficient, the benefits youth derive from such participation were included.

**C) Have any problems arisen in relation to youth issues or integrating youth into the CRP's research?**

In Ethiopia, youth groups were identified as a successful mechanism to promote CRP technologies and practices. However, because of their low membership numbers (below 50), these groups have not been eligible to formalize their status with the government.

**1.3.3 Capacity Development**

In 2019, the CRP Livestock finalized its capacity development strategy for the 2019-2021 period and implemented a range of initiatives, including facilitating community conversations, developing training modules and conducting training workshops (both in-person and through digital extension channels). CRP scientists and partners assessed capacity needs and conducted due diligence on solution providers in several countries across multiple livestock value chains. The CRP held short-term training and other activities with stakeholders including farmers, livestock entrepreneurs, extension officers and policymakers, reaching 13,938 individuals (34% women). During 2019, 32 undergraduate and graduate students also received long-term training, including 12 who completed their PhD studies (58% women). On scaling, the CRP piloted a detailed scaling approach, agreeing clear plans for how it will be implemented over the 2019/2021 period, and initial scaling workshops were held for the priority country team in Uganda.

Specific highlights in 2019 included:

- In Uganda, the CRP conducted due diligence on six stakeholders applying digital technology solutions to improve small holder pig farming in Uganda and facilitated needs assessments from the flagships for various capacity development activities.
- The “eWeigh” mobile application (app), which uses heart girth as a proxy measure to estimate live weight, was tested by Kenyan dairy farmers.
- Using community conversations, training modules for specific animal health issue areas were developed and rolled out, with new modules on antimicrobial use and animal welfare developed and tested.
- Multiple extension materials were developed for forage training in Central America, Colombia and Tunisia, including e-learning training modules.
- In Ethiopia, a module on community-based breeding programs was integrated into the livestock genetics curriculum of 3 universities and a tailored MSc training on breeding and genetics was introduced in 2 universities.
- Improved scaling approach led to high uptake of improved sheep fattening practices and technologies in Ethiopia.

### 1.3.4 Climate Change

Under **FP1 Livestock Genetics**, a key learning point is that East African dairy cattle show heat stress and decreased milk yields above temperature-humidity indexes of 67.5 (D20307). This information will be used to incorporate heat stress factors into the breeding objectives of dairy cattle breeding programs, allowing for future breeding of more heat-tolerant animals. The flagship also contributes to climate change adaptation by ensuring breeding programs produce genetically superior animals that are both productive and adaptive/resilient.

**FP3 Feeds and Forages** produced a feasibility study on improved silvopastoral systems in the Caribbean region of Nicaragua, including ex-ante impact assessment of greenhouse gas emissions and carbon sequestration (D10487). Elsewhere, there was a four to five-fold variation in the amount of dry matter produced across the Napier grass population when grown under limited water supply with some accessions, which continued to grow well under severe water restrictions, potentially pushing the boundaries of where this forage crop can be grown.

Tackling climate change is central to the mandate of **FP4 Livestock and the Environment**. Highlights included:

- Work on heat stress mapping for the pig value chain in Uganda, now being expanded to dairy systems in Ethiopia.
- Data collection and publication of baselines on livestock production in Tanzania and Kenya.
- Incorporation of Tier 2 data from Kenyan systems into IPCC greenhouse gas emissions guidance/databases.
- Laboratory experiments with different feeding regimes to ascertain their effectiveness in reducing greenhouse gas intensities for mixed dairy and extensive pastoral systems.
- Publication of a "best practice" brief summarizing experience to date by CCAFS and the Livestock CRP working with government partners to improve national reporting on greenhouse gas data for the livestock sector.

Under **FP5 Livestock Livelihoods and Agri-Food Systems**, climate change considerations were discussed further in the modelling related to Livestock Master Plans.

## 2. Effectiveness and Efficiency

### 2.1 Management and governance

Leadership of two flagships changed in 2019. The leader of **FP5 Livestock Livelihoods and Agri-Food Systems**, Steve Staal, retired and ILRI economist Isabelle Baltenweck was selected by the CRP Management Committee (PMC) as the best candidate to replace him. In **FP1 Livestock Genetics**, Olivier Hanotte was replaced by Karen Marshall, ILRI quantitative geneticist, with a mandate to focus on achievement of flagship outcomes and milestones and to improve timeliness of planning and reporting (the PMC monitors timeliness as a performance indicator). To strengthen the time commitment of flagship leaders and administrators to planning, reporting and managing flagship teams, flagship management costs were increased to support a larger share of their time (30%).

The major CRP management challenge in 2019 was to establish an effective interface that would facilitate flagship engagement in the Priority Country programs. The country programs add complexity and another dimension to the existing matrix of planning, funding and implementing work by the various partners across flagships for a shared, integrated agenda in each country. The experience promises lessons for the One CGIAR recommendation to strengthen country engagement.

In late 2018, the CRP Management Committee held a joint session with GIZ staff to review the role of GIZ as an implementing partner of the CRP. Based on this review, the CRP Management Committee initiated discussions with GIZ to re-align its involvement, recognizing the challenges the partnership faced during the CRP proposal approval process and from GIZ institutional constraints. A final decision will be made in

2020. A similar joint review was held with staff of the other CRP external partner: the Swedish University of Agricultural Sciences (SLU). The review confirmed the positive partnership experience to date, though noting the particular challenges for a university to partner with a CRP given constrained financial modalities and the independence of faculty.

## 2.2 Partnerships

### 2.2.1. Highlights of External Partnerships

Three Universities collaborated with ILRI on livestock genomics work under the Centre for Tropical Livestock Genetics and Health (CTLGH) and seven institutions (including research, academic, non-profit and private sector organizations) contributed to the African Dairy Genetic Gains bilateral project. A partnership with the Ethiopian Veterinary Association was key to facilitate the implementation of new delivery models for animal health services. Also in animal health, collaborations with CIRAD (*Centre de coopération internationale en recherche agronomique pour le développement*), *Institut Senegalais de Recherche Agricole* (ISRA) and *Centre International de Recherche-Développement sur l'Élevage en zone Subhumide* (CIRDES) developed study protocols and improved control strategies for *Peste des Petits Ruminants*. CIAT continued to work with private sector partner Papalotla to further the commercialization and dissemination of forage hybrids. Forage piloting and scaling in Eastern Africa was carried out with Send a Cow, SNV - Netherlands Development Organization and KALRO (Kenya Agricultural and Livestock Research Organization). ILRI worked with the Food and Agriculture Organization of the United Nations (FAO) and CIRAD on the modelling and implementation of Livestock Master Plans.

### 2.2.2. Cross-CGIAR Partnerships

The recently adopted CGIAR antimicrobial resistance (AMR) strategy recognizes the need for evidence on links between agriculture (crops, livestock and aquaculture) and public health outcomes. The CGIAR AMR Hub is led by ILRI and supported by IFPRI, WorldFish, IWMI and the CRPs on Livestock, A4NH and Fish. The Hub applies a One Health approach to support the efforts of low- and middle-income countries (LMICs) in controlling agriculture-associated AMR risks, through promoting and facilitating transdisciplinary partnerships. Based on evidence generated, the Hub develops solutions that are locally relevant and applicable, while being adaptable to other contexts. The CRP Livestock Gender Focal Point at ILRI also led the winning bid for the new CGIAR GENDER (Generating Evidence and New Directions for Equitable Results) Platform, designed to put gender equality at the forefront of global agricultural research for development. This Platform, which involves all CRPs, Platforms and CGIAR Research Centres, will transform the way gender research is done, both within and beyond CGIAR, to kick-start a process of genuine change toward greater gender equality and better lives for smallholder farmers everywhere.

## 2.3. Intellectual Assets

Have any intellectual assets been strategically managed by the CRP (together with the relevant Center) this year?

N/A

Indicate any published patents and/or plant variety right applications (or equivalent)

N/A

List any critical issues or challenges encountered in the management of intellectual assets in the context of the CRP

N/A

## 2.4 Monitoring, Evaluation, Impact Assessment and Learning (MELIA)

During 2019, a large number of planned evaluation studies within the CRP Livestock were completed. These included three ex-ante studies: one that focused on developing the dairy sector in the Kilosa district of Tanzania through systems dynamics modelling; one on the adoption of novel planted forages in Central America and the Caribbean; and another on the effects of a new *Brachiaria* variety in Columbia, supporting the decisions on development investments in these countries and regions. Three studies looked at economic indicators of introducing forages into livestock production systems, with a *Leucaena* species and improved *Brachiaria* varieties introduced to Latin American beef production systems and a suite of forages introduced to mixed livestock systems in Kenya. Another study specifically researched the adoption processes of forages in Colombia with an emphasis on constraints and opportunities. A case study report on the exploratory study of mobile animal health clinics in remote regions of northern Kenya showed that under current practices, this form of service provision would not be profitable. However, the study also showed that restricting all vaccinations to fully qualified vets is not what the law requires, which has led to a broader discussion on how to best improve service delivery in remote areas. Finally, the four country projects within the CRP Livestock published their research strategies. Several studies were extended because managing data collection and preparing final publications took longer than expected. Journal papers are under preparation for the assessment of the infection and treatment method (ITM) vaccine in Tanzania, and in the case of Ethiopia for the assessment of smart marketing interventions and for best bet productivity interventions. For the study on variety selection and adoption for dual-purpose groundnut in Odisha (India) further data is being collected, in part due to the considerable delay by the state variety selection board to select the new dual-purpose variety. The assessment of community herd health interventions has provided data useful for participatory processes but is yet insufficient for a publication. Finally, two planned studies were cancelled because required funding could not be secured: (i) Although the value of an assessment of the effects of promoted technologies within the large development project “Accelerating Value Chain Development” (AVCD) was highly appreciated, the existing monitoring data was not sufficient for such an evaluation and funds for collecting additional data were not available; and (ii) the evaluation of exclosure practices for rehabilitating rangelands in Ethiopia could not go ahead because the funding application was rejected.

## 2.5 Efficiency

Two efficiency gains were achieved in 2019. The first relates to the joint development of greenhouse gas assessment methodology and capacity by both CCAFS and the Livestock CRP, reducing duplication of effort and cost. Second, investment in IT solutions for information collection, management and application for detection and response to implementation problems in large scale projects is reducing replicated efforts and improving effectiveness. Examples include use of cloud computing to reduce IT administration overheads, use of database-driven dashboards to summarize project status and the creation of opportunities for data sharing and interoperability with partner IT systems. Such gains have been achieved by the Livestock Genetics flagship with the National Animal Genetic Improvement Institute in Ethiopia and Green Dreams in Kenya and Ethiopia.

## 2.6 Management of Risks to Your CRP

**Programmatic:** Previously noted risks associated with outcomes and targets that do not reflect the early termination of CRPs and the disruption of W1/2 funded activities remain relevant. To address the latter, CRP management is analyzing planned research efforts within a livestock initiative to bridge into the post-CRP phase, so that closure of research to be discontinued and associated partnerships can be managed appropriately. The One CGIAR process opens up new potential risks of diverting significant resources towards planning efforts and reducing commitment to CRP implementation. The CRP is planning a major (virtual) team meeting in mid-2020 to encourage researcher “buy-in” and strengthen commitment to developing a well-managed closure strategy. Finally, co-funding requirements for the bilateral project portfolio have increased significantly, leveraging a large portion of work directly contributing to the CRP

but raises the question for Centre management of the need for a source of co-funding to maintain projects after 2021.

**Institutional:** The previously recorded risk of potential erosion of synergies achieved in livestock-related capacities across CRP partners continues to be relevant given the uncertainty associated with the One CGIAR process. In response, CRP management has supported the development of the livestock initiative noted above to facilitate embedding and strengthening of these synergies.

**Contextual:** Insecurity in Ethiopia, Nicaragua, Burkina Faso and Mali continues to affect the ability of the CRP to implement planned research activities and teams have adapted their plans accordingly. In Nicaragua, for example, activities have been decentralized and are being coordinated with local rather than national authorities.

### 2.7 Use of W1-2 Funding

W1/2 contributions to **FP1 Livestock Genetics** supported the 4 OICRs, 8 innovations and 4 policies that are reported in this annual report. In **FP3 Feeds and Forages**, W1/2 funds were used among other things to support *Urochloa/Megathyrus* and barley breeding programs, identify candidate genes/markers associated with important forage traits which can be used for the initiation of marker assisted selection to develop new cultivars (Napier), and tools development for better targeting of technologies. In **FP5 Livestock Livelihoods and Agri-Food Systems**, W1/2 funds supported the work on Livestock Master Plans and policy engagement on youth. The CRP priority country work (situated under FP5 but with activities across all flagships) is 100% funded by W1/2.

## 3. Financial Summary

The budget figures included in Table 13 are as per the submitted POWB 2019. W1/2 expenditure was 7% lower than budgeted, despite the allocation of additional funds during the year to priority country projects (not included in the original POWB 2019 but updated during Upkeep phase in MARLO). W3 and bilateral expenditure during the year was 32% higher than budgeted, reflecting a combination of funding carried over from 2018 due to delayed start of several major projects (not factored into the original POWB 2019), and the approval of multiple additional grants to the participating CGIAR Centres and resulting implementation of activities during the year; it is important to stress that the recorded variances in W3/Bilateral expenditures were therefore supported by available funding and do not represent overruns. The requirement for Centre Own Funds was expected to be approximately US\$640,000 from ILRI but the actual expenditure was only just over US\$312,000 due to relief provided from additional W3/bilateral funds secured during the year. CIAT also contributed a small amount of its own funds towards management costs, although overall the CRP management and support costs were lower than expected.

## Part B. TABLES

**Table 1: Evidence on Progress towards SRF targets (Sphere of interest)**

SLO Target (2022)	Brief summary of new evidence of CGIAR contribution	Expected additional contribution before end of 2022
100 million more farm households have adopted improved varieties, breeds, trees, and/or improved management practices.	The total area sown with CIAT hybrids under FP3 Feeds and Forages is estimated at 1 million hectares in 30 countries by the end of 2019.	CIAT expects further adoption of improved hybrids on 100,000 hectares annually in at least 15 countries.
30 million people, of which 50% are women, assisted to exit poverty	No new evidence in 2019.	
2.5 million ha of forest saved from deforestation	N/A	
Improve the rate of yield increase for major food staples from current < 1% to 1.2-1.5% per year	No new evidence in 2019.	
30 million more people, of which 50% are women, meeting minimum dietary energy requirements	No new evidence in 2019.	
150 million more people, of which 50% are women, without deficiencies of one or more of the following essential micronutrients: iron, zinc, iodine, vitamin A, folate, and vitamin B12	No new evidence in 2019.	

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10% reduction in women of reproductive age who are consuming less than the adequate number of food groups	No new evidence in 2019.	
5% increase in water and nutrient (inorganic, biological) use efficiency in agro-ecosystems, including through recycling and reuse	N/A	
Reduce agriculturally-related greenhouse gas emissions by 0.2 Gt CO <sub>2</sub> -e yr <sup>-1</sup> (5%) compared with business-as-usual scenario in 2022	No new evidence in 2019.	
55 million hectares (ha) degraded land area restored	No new evidence in 2019.	

**Table 2: Condensed list of policy contributions in this reporting year (Sphere of Influence)**

Title of policy, legal instrument, investment or curriculum to which CGIAR contributed	Description of policy, legal instrument, investment or curriculum to which CGIAR contributed	Level of Maturity	Link to sub-IDOs (max. 2)	CGIAR cross-cutting marker score				Link to OICR (obligatory if Level of Maturity is 2 or 3) or link to evidence
				Gender	Youth	Capdev	Climate Change	
302 - Incorporation of issues relevant to pastoralists and rangelands in Kenya National Land Commission Guidelines and Toolkits for County Spatial Planning	Kenyan counties are required to produce county spatial plans. ILRI assisted the National Land Commission to develop methods to do this in pastoral areas.	Level 2	<ul style="list-style-type: none"> <li>Land, water and forest degradation (Including deforestation) minimized and reversed</li> <li>More productive and equitable management of natural resources</li> </ul>	0 - Not Targeted	0 - Not Targeted	0 - Not Targeted	1 - Significant	<a href="#">OICR3108</a>
306 - Investment of US\$7.15 million by the Government of Tanzania (through Global Environment Facility) to upscale Joint Village Land Use Planning in 5 Districts	Joint village land use planning (JVLUP) is a process of planning across villages in order to protect shared resources, including grazing for local communities, supported by government policy and legislation.	Level 2	<ul style="list-style-type: none"> <li>Enhanced adaptive capacity to climate risks (More sustainably managed agro-ecosystems)</li> <li>Increased access to productive assets, including natural resources</li> <li>More productive</li> </ul>	0 - Not Targeted	0 - Not Targeted	1 - Significant	0 - Not Targeted	<a href="#">OICR3091</a>

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			and equitable management of natural resource					
349 - International private sector breeding companies and Bill & Melinda Gates Foundation investments in supporting the breeding of farmer preferred and best performing chicken breeds in Africa	A partnership was created between ILRI and Hendrix Genetics to implement the Sustainable Access to Poultry Parental Stock to Africa (SAPPSA) breeding program funded by Bill & Melinda Gates Foundation	Level 2	<ul style="list-style-type: none"> <li>• Increased livelihood opportunities</li> <li>• Increased value capture by producers</li> </ul>	1 - Significant	1 - Significant	0 - Not Targeted	0 - Not Targeted	<a href="#">OICR3297</a>
350 - National private sector hatcheries and Bill & Melinda Gates Foundation investments for the breeding of farmer preferred and best performing chicken breeds in Tanzania and Nigeria	The African Chicken Genetic Gains program identified farmer preferred and locally adapted chicken strains for different geographies, which will now be bred by companies in Ethiopia, Tanzania and Nigeria.	Level 2	<ul style="list-style-type: none"> <li>• Increased livelihood opportunities</li> <li>• Increased value capture by producers</li> </ul>	1 - Significant	1 - Significant	0 - Not Targeted	0 - Not Targeted	<a href="#">OICR3297</a>
351 - Investment of Euros 1.5 million by the European Union in the piloting of participatory rangeland management in Kenya and Tanzania	Participatory rangeland management (PRM) is an innovation developed by ILRI and partners. In 2018 the European Union invested Euro 1.5 million in piloting PRM in Kenya and Tanzania.	Level 2	<ul style="list-style-type: none"> <li>• More productive and equitable management of natural resources</li> <li>• Increased access to productive assets, including natural resources</li> <li>• Enhanced adaptive capacity to climate</li> </ul>	0 - Not Targeted	0 - Not Targeted	1 - Significant	0 - Not Targeted	<a href="#">OICR3115</a>

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			risks (More sustainably managed agro-ecosystems)					
p352 - Adoption by Government of Ethiopia of Woreda Participatory Land Use Planning methodology for pastoral areas developed by ILRI and partners	In 2019 the Government of Ethiopia launched the manuals on the <i>woreda</i> (district) participatory land use planning approach for pastoral areas. The Government is now seeking funding to up-scale.	Level 1	<ul style="list-style-type: none"> <li>Enhanced adaptive capacity to climate risks (More sustainably managed agro-ecosystems)</li> <li>More productive and equitable management of natural resources</li> <li>Increased access to productive assets, including natural resource</li> </ul>	0 - Not Targeted	0 - Not Targeted	1 - Significant	0 - Not Targeted	<a href="#">OICR3164</a>
354 - Incorporation of community-based breeding program module into curriculum of 3 universities and introduction of tailored MSc training on breeding and genetics in 2 universities in Ethiopia	Incorporation of module on community-based breeding program into the livestock genetics curriculum of 3 universities and introduction of tailored MSc training on breeding and genetics in 2 universities in Ethiopia.	Level 2	<ul style="list-style-type: none"> <li>Increased livelihood opportunities</li> </ul>	0 - Not Targeted	2 - Principal	2 - Principal	0 - Not Targeted	<a href="#">OICR3271</a>
355 - Commitment of \$560,000 by the Ethiopian Government to scale up small ruminant community-	Small ruminant community-based breeding programs adopted by the Ethiopian government in the Ethiopia Livestock and	Level 1	<ul style="list-style-type: none"> <li>Increased access to diverse nutrient-rich foods</li> </ul>	0 - Not Targeted	0 - Not Targeted	0 - Not Targeted	0 - Not Targeted	<a href="#">OICR3269</a>

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based breeding programs	Fisheries Sector Development Project with a commitment of \$560,000 to fund scaling of the model							
364 - Inclusion of livestock in the key messages in the 15th CAADP Partnership Platform Meeting Communiqué, Nairobi, Kenya	Further to a side event that highlighted the role of livestock in African economies, the final communiqué of the 15th CAADP Partnership Platform Meeting called for greater investments in the sector and stressed the need for better messaging on livestock.	Level 2	<ul style="list-style-type: none"> <li>• Conducive agricultural policy environment</li> </ul>	0 - Not Targeted	0 - Not Targeted	0 - Not Targeted	0 - Not Targeted	<a href="#">OICR3306</a>
372 - Clarification of the legal basis for the private sector to deliver veterinary vaccines in Kenya	Analysis of existing statutes has showed that the private sector is legally allowed to administer livestock vaccinations in Kenya, whereas previously it was believed only public sector could do so.	Level 1	<ul style="list-style-type: none"> <li>• Closed yield gaps through improved agronomic and animal husbandry practices</li> </ul>	0 - Not Targeted	0 - Not Targeted	0 - Not Targeted	0 - Not Targeted	ILRI identified a policy constraint, namely that animal health service delivery was not profitable in extensive systems because the private sector was not allowed to deliver vaccines. The Government of Kenya convened stakeholders to discuss the issue, leading to drafting of a government circular (not yet published), and ILRI wrote a blog describing the process: <a href="https://www.ilri.org/news/can-private-sector-deliver-livestock-vaccines-kenya-yes-they-can">https://www.ilri.org/news/can-private-sector-deliver-livestock-vaccines-kenya-yes-they-can</a>
373 - Review of veterinary laws in Kenya	Review of existing veterinary laws to align	Level 1	<ul style="list-style-type: none"> <li>• Closed yield gaps through improved</li> </ul>	1 - Significant	0 - Not Targeted	0 - Not Targeted	0 - Not Targeted	ILRI supported the Director of Veterinary Services in Kenya to review veterinary

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	with the Constitution of Kenya 2010 and current best practices		agronomic and animal husbandry practices					<p>laws (some as old as 100 years) to bring them in line with current best practices and the new constitution. The three draft bills are published in the Kenya Gazette and waiting to be presented to the National Assembly for debate. If passed they will be sent to the President for assent before they become law.</p> <p><a href="http://www.kilimo.go.ke/wp-content/uploads/2019/11/Animal-Health-Bill-2019.pdf">http://www.kilimo.go.ke/wp-content/uploads/2019/11/Animal-Health-Bill-2019.pdf</a></p> <p><a href="http://www.kilimo.go.ke/wp-content/uploads/2019/11/Veterinary-Public-Health-Bill-2019.pdf">http://www.kilimo.go.ke/wp-content/uploads/2019/11/Veterinary-Public-Health-Bill-2019.pdf</a></p> <p><a href="http://www.kilimo.go.ke/wp-content/uploads/2019/11/Animal-Welfare-and-Protection-Bill-2019.pdf">http://www.kilimo.go.ke/wp-content/uploads/2019/11/Animal-Welfare-and-Protection-Bill-2019.pdf</a></p>
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**Table 3: List of Outcome/ Impact Case Reports from this reporting year (Sphere of Influence)**

Title of Outcome/ Impact Case Report (OICR)	Link to full OICR	Maturity level	Status
OICR2729 - RHoMIS (a standardized, cost-effective rural household survey tool) is adopted by 13 organizations to guide investments and generate information on 30,000 households in 31 countries	<a href="#">Link</a>	Level 1	Updated Outcome/Impact case at same level of maturity
OICR3091 - Adoption of joint village land use planning (JVLUP) by the Government of Tanzania to increase tenure security for livestock keepers	<a href="#">Link</a>	Level 2	New Outcome/Impact Case
OICR3094 - Gender transformative community conversations that lead to improved gender relations and better livestock health management practices adopted by research and development actors in Ethiopia	<a href="#">Link</a>	Level 1	New Outcome/Impact Case
OICR3097 - The Rural Household Multi Indicator Survey (RHoMIS) tool is adopted as the standard monitoring and evaluation tool by TREE AID	<a href="#">Link</a>	Level 2	New Outcome/Impact Case
OICR3099 - Use of improved dissemination strategies leading to high adoption of new drought tolerant barley variety (Kounouz)	<a href="#">Link</a>	Level 2	New Outcome/Impact Case
OICR3108 - Development and dissemination of guidance for County Spatial Planning in pastoral areas in Kenya derived from synthesis of research on pastoralist land use	<a href="#">Link</a>	Level 2	New Outcome/Impact Case
OICR3115 - Participatory rangeland management (PRM) being piloted in Kenya and Tanzania covering 246,773 ha of pastoralists' communal grazing lands	<a href="#">Link</a>	Level 2	New Outcome/Impact Case
OICR3164 - Adoption of woreda participatory land use planning (WPLUP) in pastoral areas by government of Ethiopia	<a href="#">Link</a>	Level 1	New Outcome/Impact Case
OICR3269 - Community-based breeding programs upscaled in Ethiopia and other African countries through partners	<a href="#">Link</a>	Level 2	New Outcome/Impact Case
OICR3271 - Community-based breeding programs incorporated into Wollega, Haromaya and Hawassa national universities curricula in Ethiopia	<a href="#">Link</a>	Level 2	New Outcome/Impact Case
OICR3272 - Better cattle breeds introduced into the Tanzanian national artificial insemination program for improved dairy productivity for smallholder farmers	<a href="#">Link</a>	Level 1	New Outcome/Impact Case

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OICR3297 - Scale-up and delivery of more productive and resilient chicken breeds to African smallholder farmers is taken up by local hatcheries and international breeding companies	<a href="#">Link</a>	Level 1	New Outcome/Impact Case
OICR3306 - Importance of livestock sector highlighted in the final communique of the 15th Comprehensive Africa Agriculture Development Programme Partnership Platform Meeting in Nairobi, Kenya	<a href="#">Link</a>	Level 1	New Outcome/Impact Case
OICR3307 - Targeted messaging on livestock's contribution to nutrition and livelihoods in developing countries provides a more balanced and inclusive perspective to the 2019 EAT Lancet Report	<a href="#">Link</a>	Level 1	New Outcome/Impact Case
OICR3308 - Women's Empowerment in Livestock Index adopted by four International Development Research Centre projects to measure women's empowerment in animal vaccine interventions	<a href="#">Link</a>	Level 1	New Outcome/Impact Case

**Table 4: Condensed list of innovations by stage for this reporting year**

Title of innovation with link	Innovation Type	Stage of innovation	Geographic scope (with location)
<a href="#">87 - Women Empowerment in Livestock Index (WELI)</a>	Social Science	Stage 4: uptake by next user (USE)	Global
<a href="#">279 - Woreda Participatory Land Use Planning for Pastoral Areas in Ethiopia</a>	Social Science	Stage 4: uptake by next user (USE)	National
<a href="#">447 - Gendered Feed Assessment Tool (G-FEAST)</a>	Research and Communication Methodologies and Tools	Stage 3: available/ ready for uptake (AV)	Global
<a href="#">450 - Mobile, handheld and affordable Near Infra-Red Spectrometry (NIRS) instruments</a>	Research and Communication Methodologies and Tools	Stage 3: available/ ready for uptake (AV)	Global
<a href="#">1064 - Release of Urochloa “Camello Blend (GP 3025 + GP 3207)” in Bolivia, Ecuador and Paraguay</a>	Genetic (varieties and breeds)	Stage 3: available/ ready for uptake (AV)	Multi-national, Ecuador, Bolivia, Paraguay
<a href="#">1065 - New forage variety (Panicum maximum cv. “Sabanera”) released in Colombia</a>	Genetic (varieties and breeds)	Stage 3: available/ ready for uptake (AV)	National, Colombia
<a href="#">1066 - New barley genotypes identified with superior forage, grain and biomass production after cutting</a>	Genetic (varieties and breeds)	Stage 1: discovery/proof of concept (PC - end of research phase)	Global
<a href="#">1067 - Guidelines for cactus pear establishment and maintenance in India</a>	Production systems and Management practices	Stage 3: available/ ready for uptake (AV)	Global
<a href="#">1068 - Business model for pellet producing enterprises</a>	Other	Stage 1: discovery/proof of concept (PC - end of research phase)	National, Tunisia

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<a href="#">1071 - Methods for county spatial planning in pastoral rangelands for strengthened land rights and improved management of natural resources</a>	Production systems and Management practices	Stage 4: uptake by next user (USE)	National, Kenya
<a href="#">1075 - Three new barley varieties released (PL891 in India and Ramtha1 and Ghweir1 in Jordan).</a>	Genetic (varieties and breeds)	Stage 3: available/ ready for uptake (AV)	Multi-national, India, Jordan
<a href="#">1076 - Mobile grinder for chopping livestock feed</a>	Biophysical Research	Stage 3: available/ ready for uptake (AV)	National, Tunisia
<a href="#">1078 - Approach for sustainable restoration of silvopasture production systems in Tunisia</a>	Production systems and Management practices	Stage 3: available/ ready for uptake (AV)	National, Tunisia
<a href="#">1085 - New approach to targeting feed options at scale in East Africa using global data sets</a>	Research and Communication Methodologies and Tools	Stage 1: discovery/proof of concept (PC - end of research phase)	Regional, Eastern Africa
<a href="#">1088 - Spectra standardization to ILRI master Near Infra-Red Spectrometry (NIRS) instruments</a>	Research and Communication Methodologies and Tools	Stage 3: available/ ready for uptake (AV)	Regional, Western Africa, Southern Asia, Eastern Africa
<a href="#">1089 - List of top performing Napier grass genotypes identified for broader testing across systems and agroecologies</a>	Genetic (varieties and breeds)	Stage 1: discovery/proof of concept (PC - end of research phase)	Global
<a href="#">1090 - Guide to the production of High-Quality Cassava Peel® mash as a livestock feed</a>	Production systems and Management practices	Stage 3: available/ ready for uptake (AV)	National, Nigeria
<a href="#">1091 - Enhanced policy recommendations for sustainable rangeland improvement in Tunisia</a>	Social Science	Stage 3: available/ ready for uptake (AV)	National, Tunisia
<a href="#">1097 - Toolbox for sustainable rehabilitation of rangelands in arid environments</a>	Production systems and Management practices	Stage 1: discovery/proof of concept (PC - end of research phase)	Regional, Central Asia, Northern Africa, Western Asia, Sub-Saharan Africa
<a href="#">1143 - Participatory Rangeland Management (PRM) in Tanzania and Kenya</a>	Social Science	Stage 2: successful piloting (PIL - end of piloting phase)	Multi-national, United Republic of Tanzania, Kenya

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<a href="#">1149 - Digital tool (Application Processing Interphase) for interaction with, and data capture from, smallholder dairy cattle farmers</a>	Production systems and Management practices	Stage 2: successful piloting (PIL - end of piloting phase)	Regional, Eastern Africa
<a href="#">1150 - Methodological framework for upscaling community based breeding programs</a>	Genetic (varieties and breeds)	Stage 3: available/ ready for uptake (AV)	Regional, Eastern Africa, Southern Africa
<a href="#">1151 - Identification of a candidate gene for prolificacy in Bonga sheep</a>	Genetic (varieties and breeds)	Stage 1: discovery/proof of concept (PC - end of research phase)	National, Ethiopia
<a href="#">1171 - Participatory process for developing system dynamics models to guide interventions</a>	Social Science	Stage 3: available/ ready for uptake (AV)	Global
<a href="#">1176 - Livestock value chain assessment toolkit</a>	Social Science	Stage 3: available/ ready for uptake (AV)	Global
<a href="#">1178 - Public private partnership in delivery of artificial insemination services</a>	Social Science	Stage 2: successful piloting (PIL - end of piloting phase)	National, Kenya
<a href="#">1179 - Social and behavioural change communication strategy for improving consumption of animal source foods in Rwanda</a>	Social Science	Stage 3: available/ ready for uptake (AV)	National, Rwanda
<a href="#">1195 - Epidemiology and Control of Peste des Petits Ruminants (ECO-PPR) toolbox</a>	Production systems and Management practices	Stage 2: successful piloting (PIL - end of piloting phase)	Global
<a href="#">1197 - Disease risk maps for Porcine Reproductive and Respiratory Syndrome (PRRS) and Foot-and-Mouth Disease (FMD) in Vietnam</a>	Production systems and Management practices	Stage 2: successful piloting (PIL - end of piloting phase)	Global
<a href="#">1198 - Model to assess control scenarios for key livestock diseases</a>	Production systems and Management practices	Stage 2: successful piloting (PIL - end of piloting phase)	Global
<a href="#">1199 - Animal health resource centers (AHRC) in Ethiopia</a>	Production systems and Management practices	Stage 2: successful piloting (PIL - end of piloting phase)	National, Ethiopia
<a href="#">1200 - Goat Annual Reproductive Performance Index (G-ARPI)</a>	Production systems and Management practices	Stage 2: successful piloting (PIL - end of piloting phase)	National, Ethiopia

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<a href="#">1201 - Community Conversation training module on animal welfare</a>	Production systems and Management practices	Stage 3: available/ ready for uptake (AV)	National, Ethiopia
<a href="#">1205 - e-learning training material for dairy cattle keepers</a>	Production systems and Management practices	Stage 2: successful piloting (PIL - end of piloting phase)	National, Kenya
<a href="#">1207 - Antimicrobial use in livestock production systems (AMUSE Livestock) tool version 2</a>	Production systems and Management practices	Stage 1: discovery/proof of concept (PC - end of research phase)	Global
<a href="#">1208 - Community conversation training module on antimicrobial use and resistance</a>	Production systems and Management practices	Stage 3: available/ ready for uptake (AV)	National, Ethiopia
<a href="#">1209 - Innovation Platforms (IPs) in Mali</a>	Production systems and Management practices	Stage 2: successful piloting (PIL - end of piloting phase)	National, Mali
<a href="#">1210 - Public-Private Partnership model to link mobile clinical veterinary services with Woreda (county) veterinary offices in Ethiopia</a>	Production systems and Management practices	Stage 1: discovery/proof of concept (PC - end of research phase)	National, Ethiopia
<a href="#">1407 - Methodological framework for field implementation of sire certification for small ruminant community based breeding programs</a>	Genetic (varieties and breeds)	Stage 1: discovery/proof of concept (PC - end of research phase)	Regional, Eastern Africa
<a href="#">1424 - Protocol and pipeline for identifying superior cross-bred dairy bulls for use in smallholder farming systems, including via the use of genomics</a>	Genetic (varieties and breeds)	Stage 1: discovery/proof of concept (PC - end of research phase)	Regional, Eastern Africa
<a href="#">1425 - Technology for biobanking African poultry breeds (primordial germ cell cryo-storage)</a>	Genetic (varieties and breeds)	Stage 3: available/ ready for uptake (AV)	Regional, Sub-Saharan Africa
<a href="#">1426 - Mobile FeedApps to formulate chicken rations from locally available ingredients (1 each for Tanzania, Nigeria, and Ethiopia)</a>	Production systems and Management practices	Stage 3: available/ ready for uptake (AV)	Regional, Western Africa, Eastern Africa
<a href="#">1427 - Methodology to determine breed suitability for different agro-ecological zones using geographic information system tools and knowledge of genotype by environment interactions</a>	Production systems and Management practices	Stage 1: discovery/proof of concept (PC - end of research phase)	Global

**Table 5: Summary of status of Planned Outcomes and Milestones (Sphere of Influence-Control)**

FP	FP Outcomes 2022	Sub-DOs	Summary narrative on progress against each FP outcome this year.	Milestone	2019 milestones status	Provide evidence for completed milestones (refer back to means of verification, and link to evidence wherever possible) or explanation for extended, cancelled or changed	Link to evidence
F1	F1 Outcome: Outcome 1.1: Data on livestock diversity and systems, including from a gendered lens, used to develop or refine genetic improvement and / or conservation strategies by policymakers, national research and development partners, and the private sector, in 5 CRP priority countries and other locations.	Increased conservation and use of genetic resources	Plans to establish an advanced dairy cattle research facility at ILRI's Kapiti research station were abandoned due to lack of funding (milestone 1.1.5). This means that some anticipated flagship work e.g. a study on the milk-yield of various breeds dairy cattle to different planes of nutrition are unable to be undertaken at this stage. However excellent data on livestock systems and animal performance is being accumulated through other flagship initiatives (e.g. milestone 1.1.7) that will eventually allow for analysis similar to that planned on the research station	2019 - 1.1.5 Dairy cattle research facilities operationalized at ILRI's Kapiti research station in Kenya	Cancelled	The anticipated funding for this did not become available and no alternate funding sources have been identified to date nor seem likely in the near future. This milestone is thus cancelled.	

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			data (though under a longer timeframe).				
				2019 - 1.1.7 Farmer friendly mobile application for dairy cattle performance data capture and feedback developed and in use in Ethiopia and Tanzania by a minimum of 2000 farmers in each country.	Extended	Progress has been made on mobile application development, with piloting by smallholder-farmers underway in Kenya. In Tanzania and Ethiopia, internet coverage is not as extensive hence farmer access and adoption of tools is not yet fully rolled out. Political strife in Ethiopia has also slowed down the rate of engagement with farming communities.	
	F1 Outcome: Outcome 1.2 Genetic improvement strategies for improved livestock genetics implemented by national research and development partners, and the private sector in 6 CRP priority countries and other locations.	Closed yield gaps through improved agronomic and animal husbandry practices	The flagship is supporting genetic improvement strategies for dairy cattle, small ruminants, pigs and chicken. Milestones for 2019 related to the dairy cattle genetic improvement program include: the availability of a genomic tool (for determining parentage and breed composition of animals), which is currently in development with commercial partners (milestone 1.2.4; still ongoing); and, use of a customized breeding objective to ensure genetically improved cattle meet the needs and	2019 - 1.2.4 Availability of zebu x taurine admixture SNPs chips for screening of dairy cattle crossbreed in Ethiopia and Tanzania by August 2018.	Extended	The background work in development of this tool is complete (i.e. the SNPs for breed composition and parentage determination have been identified). Two commercial companies (IGSS and Livestock Genetic Analysis) have been contacted in relation to production of the chip, and discussions with them are still ongoing.	<a href="https://www.journalofdairyscience.org/article/S0022-0302(18)30701-X/abstract/">https://www.journalofdairyscience.org/article/S0022-0302(18)30701-X/abstract/</a>

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			preferences of the smallholder farmers (milestone 1.2.6; also still ongoing).				
				2019 - 1.2.6 Breeding objectives defined for smallholders dairy production systems in Eastern Africa and used to select future breeding values by the private sectors and governmental breeding companies.	Extended	Data is still building-up for the identified breeding objective to be incorporated into the breeding program: it is expected that the breeding objective will be in use to identify genetically superior dairy cattle by 2021.	
	F1 Outcome: Outcome 1.3 Business models for multiplication and delivery of improved livestock genetics, to resource poor women and men livestock keepers, implemented by national research and development partners, and the private sector in five CRP priority countries and other locations.	Technologies that reduce women's labor and energy expenditure adopted	Towards business models for multiplication and delivery of improved livestock genetics, a network of reproductive labs supporting delivery systems for small ruminants has been established in two countries (milestone 1.3.3) and business models for artificial insemination of dairy cattle have been established and tested in one country (milestone 1.3.4). Whilst not listed as a 2019 milestone, work towards establishing business models for delivery of improved chicken and pigs is also ongoing. Genetic gains and distribution of better chicken breeds are described in an OICR.	2019 - 1.3.3 A network of reproductive technology labs to improve fertility and the delivery of improved genetics established for sheep in Ethiopia (9 laboratories) and goat in Tanzania (2 laboratories).	Complete	Platforms for the certification of sires and for the delivery of reproductive technologies to support community based breeding programs for four sheep and three goat breeds are ongoing in Ethiopia. These were operationalized in collaboration with national partners.	<a href="https://hdl.handle.net/20.500.11766/10835">https://hdl.handle.net/20.500.11766/10835</a>

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				2019 - 1.3.4 Business models for delivery of improved genetics relevant to Ethiopia, Tanzania, and Kenya established by October 2019 and tested in Kenya	Extended	Two business models are being piloted in Kenya: in the first county governments are subsidizing farmers' access to breeding services through a digital voucher system; in the second a private breeding service provider (Gene plus) is charging for the service. Similar business model options will be tested in Tanzania under the CRP priority country initiative.	
	F1 Outcome: Outcome 1.5 Guidelines on policy and institutional arrangements for improvement and conservation of animal genetic resources (AnGR) adopted by policymakers, national research and development partners, and the private sector, in at least 4 priority countries and other locations.	Closed yield gaps through improved agronomic and animal husbandry practices	Towards policy and institutional arrangements on animal genetic resource use, smallholder poultry platforms were established in three countries with an aim (amongst other) of identifying and establishing appropriate delivery models for improved genetics coupled with strong private sector involvement. Moving forward, less emphasis will be placed on this outcome due to the generally favourable institutional and policy environment around animal genetic improvement in the flagship target countries.	2019 - 1.5.3 One smallholder poultry forum in Nigeria, Tanzania and Ethiopia established and registered in each country .	Complete	In Nigeria, Tanzania and Ethiopia a smallholder poultry platform was established in each to serve as the means for value chain diagnosis, challenge identification and solution co-creation to ensure the development of appropriate delivery models for improved chicken breeds for smallholder farmers.	<a href="http://dagris.info/acg/crp-final/OPP1112198_ILR1_technical_narrative_may_2018_to_may_2019_final.docx">http://dagris.info/acg/crp-final/OPP1112198_ILR1_technical_narrative_may_2018_to_may_2019_final.docx</a>

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F2	F2 Outcome: Outcome 2.1 Assessment tools for significance of animal diseases and risk maps for emergence of animal diseases are used by 100 local and national and 50 international research partners and donors to prioritize research and development interventions to reduce livestock disease risks for livestock keepers.	Reduced livestock and fish disease risks associated with intensification and climate change	Various publications on disease priorities and risk and disease models that underline the need for more attention to endemic diseases at policy level have been published. Results are being taken up by the governments in Vietnam and in Ethiopia as part of an initiative to strengthen veterinary services that focus increasingly on these neglected endemic diseases. Developed approaches and tools are used by partners within and outside CGIAR.	2019 - 2 epidemiological risk models (pig and small ruminant disease) developed, and modelling framework for assessment of PPR control and eradication defined, by end of 2018.	Complete	Risk modelling frameworks have been developed, tested, and published for 2 diseases. The control scenario evaluation framework is being applied in Uganda in pigs. For Peste des Petits ruminants (PPR) in small ruminants, data collection to feed into models has been initiated in 6 countries.	<a href="https://cgspace.cgiar.org/handle/10568/105980">https://cgspace.cgiar.org/handle/10568/105980</a> <a href="https://cgspace.cgiar.org/handle/10568/99201">https://cgspace.cgiar.org/handle/10568/99201</a>
				2019 - 2.1.5 Gender-sensitive tool developed and used to collect data on PPR impact in at least 3 countries	Complete	A Peste des Petits Ruminants (PPR)-toolbox has been developed and pre-tested in Kenya, with data collection initiated in Kenya, Uganda, Senegal, Mali and Burkina Faso. The toolbox includes a suite of gender sensitive survey tools to collect data on PPR epidemiology and socio-economic impact that complement each other and can be applied in any setting. In addition, a disease prioritization framework using quantitative and qualitative	<a href="https://cgspace.cgiar.org/handle/10568/105885">https://cgspace.cgiar.org/handle/10568/105885</a>

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						gender sensitive methods has been tested and rolled out.	
				2019 - 2.1.6 Disease transmission model developed and parameterized for 1 pig disease in Vietnam	Complete	A disease transmission model for Porcine Reproductive and Respiratory Syndrome (PRRS) in pigs in Vietnam has been developed and published.	<a href="https://cgspace.cgiar.org/handle/10568/102171">https://cgspace.cgiar.org/handle/10568/102171</a>
				2019 - 2.1.7 Epidemiological data on Bluetongue Virus (BTV) prevalence from various areas in Kenya provided by ILRI Scientist to the scientific community and public services	Extended	A brief on this topic is in preparation and will be published on CGSPACE in 2020.	
	F2 Outcome: Outcome 2.2 Context specific herd health management packages adopted by farmers, extension and animal health workers in priority countries and other locations.	Closed yield gaps through improved agronomic and animal husbandry practices	Integrated animal health interventions tested since 2017 are being taken up by the CRP Livestock priority country programmes and will expand their reach. Of the training approaches tested, the most promising are the community conversation training modules, which since 2018 have reached close to 1,600 participants, with evidence of behavior change emerging. In parallel, research	2019 - Tool to determine herd health packages for the pig value chain in Uganda developed by the end of 2018.	Complete	Longitudinal work in selected small scale pig herds were conducted to obtain details on herd health/productivity challenges. This helped to devise a framework to conduct quick assessments of health/productivity at farm level. The framework will be refined in 2020.	<b>Poster presented at Agricultural Research for Development Conference, 25-26 September 2019, at Swedish University of Agricultural Sciences (see p15)</b> <a href="https://www.siani.se/wp-content/uploads/201">https://www.siani.se/wp-content/uploads/201</a>

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			within the herd health concept - identifying and analyzing underlying reasons to poor productivity - has disclosed new health and management shortcomings that will be included in the trainings.				<a href="#">9/02/agri4d 2019 re pro 190923 final.pdf</a>
				2019 - 2.2.3 Critical short-comings in pig herd health in Uganda identified by Flagship researchers	Extended	Improving pig productivity and incomes in Uganda through an environmentally sustainable and gender inclusive integrated intervention package (Uganda Priority Country Project)	
				2019 - 2.2.4 Training modules on herd health for farmers, extension agents and vets rolled out in Ethiopia	Complete	Using community conversations, training modules for specific health problems were developed and rolled out and new modules were developed and tested (antimicrobial use and animal welfare). A training of trainer module was rolled out to ensure that local service providers and researchers can conduct community conversations without CRP involvement.	<a href="https://cgspace.cgiar.org/handle/10568/105818">https://cgspace.cgiar.org/handle/10568/105818</a> <a href="https://cgspace.cgiar.org/handle/10568/106395">https://cgspace.cgiar.org/handle/10568/106395</a> <a href="https://cgspace.cgiar.org/handle/10568/107025">https://cgspace.cgiar.org/handle/10568/107025</a> <a href="https://cgspace.cgiar.org/handle/10568/105817">https://cgspace.cgiar.org/handle/10568/105817</a> <a href="https://cgspace.cgiar.org/handle/10568/106432">https://cgspace.cgiar.org/handle/10568/106432</a>

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							<a href="https://cgspace.cgiar.org/handle/10568/106206">https://cgspace.cgiar.org/handle/10568/106206</a> <a href="https://cgspace.cgiar.org/handle/10568/99264">https://cgspace.cgiar.org/handle/10568/99264</a> <a href="https://cgspace.cgiar.org/handle/10568/100525">https://cgspace.cgiar.org/handle/10568/100525</a> <a href="https://cgspace.cgiar.org/handle/10568/100524">https://cgspace.cgiar.org/handle/10568/100524</a>
	F2 Outcome: Outcome 2.3 Livestock keepers have necessary knowledge of anti-microbial resistance (AMR) and anti-parasitic resistance (APR) to change their practices accordingly, piloted in two priority countries.	Reduced biological and chemical hazards in the food system	A training module on antimicrobial use and resistance has been developed and tested in two communities in Ethiopia, involving 120 participants, with early indication of change in practices. Twenty participants received training at a training of trainer session. The trainers will roll out the module in additional communities.	2019 - 2.3.4 Potential areas identified for interventions for improvement of the use of antibiotics in three CRP countries	Extended	The surveys on antimicrobial use have been completed in Ethiopia (in press), Vietnam and Uganda with two more publications pending for Uganda. A summary report on gaps and interventions across countries is pending.	
	F2 Outcome: Outcome 2.4 National and international research partners, government agencies and the private sector use 2 novel diagnostic assays and vaccines for control of ASF, CBPP, CAPP, ECF and	Closed yield gaps through improved agronomic and animal husbandry practices	For east coast fever (ECF), nanoparticle p67C-I53-50A gave a 60% protection against an LD70 challenge with almost four times less antigen relative to previous antigen formulations. In African swine fever (ASF), construction of two CRISPR-cas9 gene deleted ASFV strains was completed.	2019 - Agreements with at least 2 private partners to commercialize improved diagnostic tests for CBPP in Kenya, Uganda, Ethiopia, Tanzania and	Extended	Improved ELISA with IDVet in France for prototype improvement and decision on commercialization to be taken by them. Lateral flow test development has not yet been completed by partners due to lack of funds. Market analysis for	

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	PPR in at least 6 priority countries.		These vaccine candidates will be tested in pigs in 2020. Screening of the T-cell response in 23 pigs after ASFV immunization has been completed. Based on the repertoire of responses in individual pigs, the data will be used to prioritize genes for subunit vaccine studies. Finally, for Contagious Caprine Pleuropneumonia (CCPP), we have shown that inactivated Mccp ILRI181 prepared according to OIE guidelines confers protection and is a promising strain to replace existing commercial vaccine strains as it exhibits faster growth rates. Live wildtype Mccp strain ILRI181 inoculated subcutaneously did not cause disease and resulted in goats immune to CCPP. This route of immunization could be used to develop a live vaccine.	Mali by the end of 2018.		lateral flow test in Kenya will be led by GALVmed in 2020 as part of the Transformation of Animal Health Services and Solution in Low to Middle Income Countries (TAHSSL) initiative.	
				2019 - 2.4.7 Phase 1 experimental ECF vaccine trials with nanoparticle antigens completed at ILRI Nairobi	Complete	Scientists at ILRI are using nanotechnology in research on vaccines to protect livestock against diseases such as East Coast fever.	<a href="https://news.ilri.org/2019/12/17/ilri-scientists-are-applying-advanced-nanovaccinology-in-development-of-new-vaccines-against-devastating-tropical-livestock-diseases/">https://news.ilri.org/2019/12/17/ilri-scientists-are-applying-advanced-nanovaccinology-in-development-of-new-vaccines-against-devastating-tropical-livestock-diseases/</a>

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				2019 - 2.4.8 African swine fever virus vaccine candidates for testing in pigs and a map of antigenic proteins from the virus available for insertion in viral vectors for subunit vaccine development	Complete	Construction of two CRISPR-cas9 gene deleted ASFV strains has been completed. These vaccine candidates will be tested in pigs in 2020. Screening of the T-cell response in 23 pigs after ASFV immunization to a synthetic peptide library of 217 ASFV genes has been completed. Based on the repertoire of responses in individual pigs, the data will be used to prioritize genes for subunit vaccine studies. For example, there was no response to 62 genes in any pig, indicating these genes are not of vaccine interest.	Donor report available on request
				2019 - 2.4.9 Methods for generating a novel Contagious Caprine Pleuropneumonia (CCPP) vaccine tested at ILRI Nairobi	Complete	Live wildtype Mccp strain ILRI181 inoculated subcutaneously does not cause disease and resulted in goats immune to CCPP.	
	F2 Outcome: Outcome 2.5 Improved access to livestock-related health services and products for female and male livestock	Closed yield gaps through improved agronomic and animal husbandry practices	Veterinary diagnostics for trade and epidemiological surveillance would play a significant role in improving animal health generally. Point of care diagnostics face major difficulties in adoption as is the	2019 - Market for diagnostics in Kenya, Uganda, Tanzania, Ethiopia and Mali assessed and cost effectiveness of producing	Extended	The effectiveness of a thermostable (stable even at moderate heat) PPR vaccine was assessed. Market for diagnostics was taken over by the new Transformation of Animal	

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	keepers in 4 priority countries		case for several other animal health services and products. Thermostable batches of the PPR vaccine have been successfully produced and will be deployed next year when the cost-effectiveness of the vaccine will be assessed	thermostable PPR vaccine analyzed by July 2018.		Health Services and Solution in Low to Middle Income Countries (TAHSSL) initiative.	
				2019 - 2.5.6 A total of 4 public-private partnership models on veterinary service delivery designed for testing in Ethiopia and Kenya	Complete	We tested public-private partnership (PPP) models on vaccine delivery and tested mobile animal health service delivery in Kenya. In Ethiopia, we designed a community conversation approach for delivery of anthelmintics (antiparasitic drugs) to small ruminant producers while in Mali we tested an innovation platform (a participatory forum for stakeholders) for delivery of vaccines.	<a href="https://cgspace.cgiar.org/handle/10568/106724">https://cgspace.cgiar.org/handle/10568/106724</a>
				2019 - 2.5.7 A total of two tested novel delivery models used by government or private sector actors to provide products and services to livestock keepers in 3 priority countries	Complete	The Kenya government has adopted and issued guidelines on private sector role in vaccine delivery.	<a href="https://cgspace.cgiar.org/handle/10568/107890">https://cgspace.cgiar.org/handle/10568/107890</a>

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F3	F3 Outcome: Outcome 3.1 - Local, national and international research and development partners, the private sector, decision-makers and livestock producers are able to diagnose feed constraints and opportunities and to effectively prioritize and target feed and forage interventions, resulting in: a 10% improvement in utilization of feeds and forages, a 20% increase in animal production using improved feed and forage technologies, a 10% accuracy increase for biomass and quality estimation and at least 250,000 annual visitors to global databases, repositories, interactive tools and maps and the Tropical Grasslands/Forrages Tropicales journal website.	Closed yield gaps through improved agronomic and animal husbandry practices	Strong advances were made in the development of new tools for feed and forage prioritization (e.g. G-FEAST, SoFT and AFAWA). However, technical issues limited the release of the updated SoFT (Selection of Forages for the Tropics) tool, which was re-scheduled for 2020. (G-)FEAST (the Gendered Feed Assessment) tool was applied in various countries (e.g. Vietnam, Rwanda, Burkina Faso). New NIRS (Near Infrared Reflectance spectroscopy process to evaluate nutrients and characteristics of a feed or forage) equations were provided for barley and mobile and stationary facilities established in Burkina Faso and Ethiopia.	2019 - 3.1.2 Research and development partners, decision makers and the private sector (input suppliers) evaluate and use improved tools such as Gendered-FEAST for on-farm (one country), and feed supply demand assessment tool for regional (one priority country) and national feed assessment (one priority country). 2 partners at each scale (on-farm, regional, national).	Complete	G-FEAST tested with development actors in Burkina Faso. Training in the use of FEAST by the IFAD-funded Rwanda Dairy Development project (RDDP) in Rwanda. G-FEAST was applied in Vietnam. Ration balancing tool (On-farm Feed Advisor) applied in India. The Vegmeasure tool was released globally.	<a href="https://hdl.handle.net/10568/107281">https://hdl.handle.net/10568/107281</a> <a href="https://hdl.handle.net/10568/107185">https://hdl.handle.net/10568/107185</a> <a href="https://hdl.handle.net/10568/106875">https://hdl.handle.net/10568/106875</a> <a href="https://www.ilri.org/research/projects/farm-feed-advisor">https://www.ilri.org/research/projects/farm-feed-advisor</a> <a href="https://repo.mel.cgiar.org/handle/20.500.11766/10560">https://repo.mel.cgiar.org/handle/20.500.11766/10560</a>
				2019 - 3.1.6 Research partners and the private sector use refined CGIAR stationary and mobile NIRS hubs in	Complete	Ethiopian private/public actors use ILRI developed NIRS equation and Indian private/public actors use ILRI NIRS facilities, as does	<a href="https://livestocklab.ifas.ufl.edu/media/livestocklabifasufledu/pdf-LIVELY-Newsletter-8-">https://livestocklab.ifas.ufl.edu/media/livestocklabifasufledu/pdf-LIVELY-Newsletter-8 -</a>

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				Eastern Africa: in 1 priority country and one other country with at least on key NARS and private sector partner each in each country		the Environmental Institute for Agricultural Research (INERA) in Burkina Faso. NIRS in Burkina Faso were established. New mobile (soft and hardware) NIRS technologies for Ethiopia were tested. Improved stationary NIRS equations for barley were provided.	<a href="#">Policies,-Projects-and-Partnerships.pdf</a>  <a href="https://cgspace.cgiar.org/handle/10568/106658">https://cgspace.cgiar.org/handle/10568/106658</a> <a href="http://hdl.handle.net/20.500.11766.1/CWW2TQ">http://hdl.handle.net/20.500.11766.1/CWW2TQ</a>
				2019 - The ICARDA Animal Feed Analysis Web Application (AFAWA) has reached at least 5,000 users by the end of 2018.	Complete	The AFAWA website has now reached more than 7,500 users (see counter on main web page).	<a href="https://afawa.icarda.org/">https://afawa.icarda.org/</a>
				2019 extended to 2020 - 3.1.12 Access of research partners to CRP generated knowledge on forages increased through 3 issues of the Tropical Grasslands journal (January, May, September) and 1 released and updated tool (SoFT)	Extended	5 issues published of the Tropical Grasslands Journal in 2019, including 2 Special Editions. The Tropical Forages Tool (formerly SoFT) is almost ready for release and a beta version was launched for testing. The final release to the public is scheduled for the first semester of 2020.	<a href="http://www.tropicalgrasslands.info/index.php/tgft/issue/archivehttps://hdl.handle.net/10568/102093">http://www.tropicalgrasslands.info/index.php/tgft/issue/archivehttps://hdl.handle.net/10568/102093</a>
F3 Outcome: Outcome 3.3 - National and international research and development partners and the private	Closed yield gaps through improved agronomic and	CIAT's Urochloa hybrids are being scaled on at least 100,000 additional hectares every year. The Urochloa and Megathyrus	2019 - 3.3.2 A total of 100,000 new hectares planted in 2019 with forage hybrids in a total	Complete	CIAT’s existing Urochloa hybrids were scaled on approximately 100,000 additional hectares in 15	2018 evidence data:	

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	sector are using CRP developed forage and rangeland resources (with enhanced traits), in 30 countries and reaching producers who plant over 2 million ha, to increase the rate of genetic gain and exploit the genetic diversity of forages and rangeland species to enhance stress-tolerance, biomass productivity and nutritive value.	animal husbandry practices	breeding programs are advancing well and developing new hybrids for different agro-ecological conditions. The barley breeding program is making strong advances with new materials being tested and disseminated to NARS partners in Morocco and Ethiopia.	of at least 15 countries (calculated based on seed sales). The total area of hybrids scaled will have reached 1,000,000 hectares in 2019 and includes all hybrids scaled since 2001		countries in 2019. The total area sown with CIAT hybrids is estimated to be 1,000,000 hectares in 30 countries by 2019. This is based on private sector estimations; evidence data will be available by mid-2020.	<a href="http://e.net/secret/chdgz23MhpzMHk">e.net/secret/chdgz23MhpzMHk</a>
				2019 - 3.3.4 10 barley genotypes with higher biomass, higher grain yield, better tolerance to biotic and abiotic stresses disseminated to NARS partners in Morocco and Ethiopia	Complete	Report on identifying 10 genotypes of barley in India with better foliar (leaf) disease resistance in combination of straw and grain yield. Report on identifying 10 genotypes of barley with better foliar disease resistance in combination of straw and grain yield in Morocco. Ethiopia was changed for India.	<a href="https://repo.mel.cgiar.org/handle/20.500.11766/10827">https://repo.mel.cgiar.org/handle/20.500.11766/10827</a> <a href="https://repo.mel.cgiar.org/handle/20.500.11766/10826">https://repo.mel.cgiar.org/handle/20.500.11766/10826</a>
	F3 Outcome: Outcome 3.4 - New forage and crop cultivars, superior to local (based on food, feed and fodder traits weighted according to target		In India, two dual purpose maize hybrids bred in CIMMYT-ILRI collaborations now occupy at least 100,000 hectares (estimated by seed production and sales). Three new barley varieties were	2019 - 3.4.1 Identified dual-purpose crops (food and feed) applied by 100,000 farmers in at least one country.	Complete	In India two dual purpose maize hybrids bred in CIMMYT-ILRI collaborations now occupy at least 100,000	

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	domains), made available by development partners, government agencies and the private sector and applied by farmers in 7 priority counties and other locations.		released (PL891 in India and Ramtha1 and Ghweir1 in Jordan), characterized by superior grain and biomass production and drought tolerance while further new barley genotypes were identified with superior forage/grain/biomass production after cutting.			hectares. Estimated by seed production and sales.	
				2019 - 3.4.4 At least three new dual purpose cultivars have been advanced into the last stage of cultivar release	Complete	Three new barley varieties released (PL891 in India and Ramtha1 and Ghweir1 in Jordan), characterized by superior grain and biomass production and drought tolerance. New barley genotypes identified with superior forage/grain/biomass production after cutting: 9 Genotypes selected for 2nd year field trials.	<a href="https://repo.mel.cgiar.org/handle/20.500.11766/10775">https://repo.mel.cgiar.org/handle/20.500.11766/10775</a> <a href="https://hdl.handle.net/20.500.11766/10347">https://hdl.handle.net/20.500.11766/10347</a> <a href="https://hdl.handle.net/20.500.11766/10086">https://hdl.handle.net/20.500.11766/10086</a>
F3 Outcome: Outcome 3.5 - National and international development partners, government agencies and extension services, the private sector and community-based organisations in 3 priority countries are using CRP-related research outputs for better utilization of	Closed yield gaps through improved agronomic and animal husbandry practices	Feed processing options were taken up by government and private sector players in Karnataka and by the government in Odisha in India.	2019 - 3.5.2 Training modules in feed processing and feeding targeting key actors in feeding, mainly women, are used by at least one national and one international development partners	Complete	Feed processing options were taken up by government and private sector players in Karnataka and by the government in Odisha in India. Training guides on HQCP (high quality cassava peel) mash for Nigeria. Training modules for silage and hay	<a href="https://hdl.handle.net/10568/106571">https://hdl.handle.net/10568/106571</a> <a href="https://hdl.handle.net/10568/107196">https://hdl.handle.net/10568/107196</a> <a href="https://hdl.handle.net/10568/107183">https://hdl.handle.net/10568/107183</a>	

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	existing and novel feed and forage resources. This will be through (a) scalable processing technologies, (b) management strategies to conserve and rehabilitate rangelands and (c) diet formulation that increases productivity while reducing overall feed and forage costs and environment impacts.			in at least 1 priority country		making. Ensilaging and drying protocols.	
				2019 - 3.5.4 At least two scalable and gender-responsive feed production and feed processing technologies are used by national and international development partners, the private sector and community-level organizations in at least one priority country	Complete	Prototype of a “mobile seed cleaning and treatment unit” developed, produced and used in Tunisia. 20 grinders distributed (with co-financing) and utilized in Tunisia. ICARDA also facilitated business linkages for seed producers.	<a href="https://hdl.handle.net/20.500.11766/10634">https://hdl.handle.net/20.500.11766/10634</a> <a href="https://hdl.handle.net/20.500.11766/10159">https://hdl.handle.net/20.500.11766/10159</a> <a href="https://hdl.handle.net/20.500.11766/10568">https://hdl.handle.net/20.500.11766/10568</a> <a href="https://hdl.handle.net/20.500.11766/10159">https://hdl.handle.net/20.500.11766/10159</a>
F3 Outcome: Outcome 3.6 - Livestock producers in 3 priority countries: apply management strategies to conserve and rehabilitate rangelands and pastures while ensuring ongoing ability to produce, preserve and store feed biomass and	More efficient use of inputs	More than 1,200 farmers adopted cactus as an alternative fodder crop in India.	2019 - 3.6.1 Well adapted cactus accessions and agronomic practices made available to a total of 1000 farmers in two different agro-ecological sites in India	Complete	More than 1,200 farmers adopted cactus as an alternative fodder crop in India. Nutrient intake/utilization of cactus in India. Group training course on agronomic practices of cactus pear in India. Guidelines for establishing	<a href="http://repo.mel.cgiar.org/handle/20.500.11766/8565">http://repo.mel.cgiar.org/handle/20.500.11766/8565</a> <a href="https://hdl.handle.net/20.500.11766/10422">https://hdl.handle.net/20.500.11766/10422</a> <a href="https://hdl.handle.net/20.500.11766/10558">https://hdl.handle.net/20.500.11766/10558</a>	

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	use diets that increase productivity while reducing overall feed and forage costs and environmental impacts (with the environment and livelihoods flagships).					cactus plantation (manual) for global use. Cactus nurseries established in India.	<a href="https://mel.cgiar.org/reporting/report/project_id/873/donor_report/1051">https://mel.cgiar.org/reporting/report/project_id/873/donor_report/1051</a>
				2019 - 2 off-farm feed processing options delivered (tested and farmers and NARS staff trained in their use) and 1 agronomic rangeland practice developed in 1 priority country (Ethiopia) and 3 further countries (India, Malawi, Afghanistan) by December 2018.	Cancelled	The feed processing options fall under Milestone 3.5.4. The rangeland practice work was moved from FP3 Feeds and Forages to FP4 Livestock and the Environment in 2018. The milestone is thus no longer relevant to FP3.	
F3 Outcome: Outcome 3.8 - Increased delivery and uptake of feed and forage resources through proof-of-concept scaling, business model development and value-chain approaches by development partners, the private sector (feed and forage traders, feed processors) and (1 million by 2022) farmers across diverse environments in		We made strong progress on (a) business model development and the provision of economic indicators for scaling sustainable feed and forage interventions in Latin America and the Caribbean (LAC), East Africa (EA), North Africa and South Asia; (b) extension approaches (including youth and gender) in North Africa and LAC that will support the uptake of technological innovations developed in this flagship; and c) on policy making	2019 - 3.8.2 At least 1 Inclusive business model for improved supply of forages and feed processing systems tested and validated in 2 countries	Complete	Cost-benefit analyses in Latin America and Caribbean and East Africa. India: forages as cash crop for women.; roadside grasses in fodder value chains. Tunisia: business model for pellet/mash, including youth and women; business linkages. Market potential of forage products in Kenya. Hay production as business.	<a href="https://hdl.handle.net/10568/105690">https://hdl.handle.net/10568/105690</a> <a href="https://hdl.handle.net/10568/106847">https://hdl.handle.net/10568/106847</a> <a href="https://doi.org/10.17138/tgft(7)359-369">https://doi.org/10.17138/tgft(7)359-369</a> <a href="https://hdl.handle.net/10568/106874">https://hdl.handle.net/10568/106874</a> <a href="https://hdl.handle.net/10568/106912">https://hdl.handle.net/10568/106912</a>	

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	priority countries and other locations in Latin America, North and East Africa and South and Southeast Asia.		for sustainable forage-based livestock production in Colombia. No changes of direction were made.				<a href="https://hdl.handle.net/10568/106619">https://hdl.handle.net/10568/106619</a> <a href="https://feeding-innovation.ilri.org/2019/03/08/feedlink-india/">https://feeding-innovation.ilri.org/2019/03/08/feedlink-india/</a> <a href="https://hdl.handle.net/20.500.11766/10159">https://hdl.handle.net/20.500.11766/10159</a> <a href="https://hdl.handle.net/20.500.11766/10568">https://hdl.handle.net/20.500.11766/10568</a> <a href="https://hdl.handle.net/10568/106918">https://hdl.handle.net/10568/106918</a> <a href="https://cgspace.cgiar.org/handle/10568/105484">https://cgspace.cgiar.org/handle/10568/105484</a>
				2019 - 3.8.6 National and international development partners and other value-chain actors pilot test at least 3 extension approaches (including at least 1 that improves women's access to information) in at least 1 country	Complete	Forage training materials for Central America. Forage training approach for Colombia. Dairy sector collaboration youth trainings in Colombia. Evaluation of 4 different extension approaches for livestock producers in Tunisia. Policy brief on extension approaches in Tunisia. E-learning training modules for Tunisian smallholders.	<a href="https://hdl.handle.net/10568/106878">https://hdl.handle.net/10568/106878</a> <a href="https://hdl.handle.net/10568/106879">https://hdl.handle.net/10568/106879</a> <a href="https://hdl.handle.net/10568/106880">https://hdl.handle.net/10568/106880</a> <a href="https://cgspace.cgiar.org/handle/10568/105523">https://cgspace.cgiar.org/handle/10568/105523</a> <a href="https://cgspace.cgiar.org/handle/10568/106800">https://cgspace.cgiar.org/handle/10568/106800</a>

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							<a href="https://hdl.handle.net/20.500.11766/10660">https://hdl.handle.net/20.500.11766/10660</a> <a href="http://repo.mel.cgiar.org/handle/20.500.11766/8389">http://repo.mel.cgiar.org/handle/20.500.11766/8389</a> <a href="https://elearning.icarda.org">https://elearning.icarda.org</a>
				2019 - 3.8.9 Private Sector is supporting uptake of improved forages in East Africa (2 countries): a) at least 1 seed company by working on improved availability of seeds and b) at least 1 dairy enterprise by supporting uptake of improved forage by their deliverers/milk farmers	Complete	We developed a feeds and forages upscaling approach for East Africa (EA). The forage seed sector in EA is emerging and developing their distribution network. The cooperation with the dairy sector in Kenya evolved and 50 demo plots were jointly established to show farmers the potential of improved forages.	<a href="https://hdl.handle.net/10568/106911">https://hdl.handle.net/10568/106911</a> <a href="https://hdl.handle.net/10568/106920">https://hdl.handle.net/10568/106920</a>
				2019 - 3.8.14 At least 1 Innovation/Multi-stakeholder Platform in at least 1 country is functioning on its own	Complete	The Colombian Roundtable is functioning on its own and technical baselines for a national level policy on sustainable bovine livestock production in Colombia have been developed and the policy is under review by the Ministry of Agriculture. It will be published in 2020.	<a href="https://cgspace.cgiar.org/handle/10568/103242">https://cgspace.cgiar.org/handle/10568/103242</a> <a href="https://cgspace.cgiar.org/handle/10568/106709">https://cgspace.cgiar.org/handle/10568/106709</a>

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						<a href="https://cgspace.cgiar.org/handle/10568/103242">https://cgspace.cgiar.org/handle/10568/103242</a> <a href="https://cgspace.cgiar.org/handle/10568/106709">https://cgspace.cgiar.org/handle/10568/106709</a> <a href="#">link</a>	
F4	<p>F4 Outcome: 4.1 Environmental concerns are considered in decision making across at least 10 priority countries and other locations, by national and international development partners, government agencies and extension systems, including technology developers seeking to improve cattle, small ruminant and pig production.</p>	More productive and equitable management of natural resources	<p>Technology developers are now considering environmental issues when setting priorities in three countries: Tanzania, Kenya and Uganda. One of the tools used is the heat stress mapping originally developed for pigs but has since expanded to dairy systems. The tools allow technology developers to understand the likely impacts of climate change (heat stress) on production systems (e.g. pigs) so that they can adapt (e.g. breeds) to these new future conditions. The CLEANED ex-ante impact assessment tool also predicts likely impacts of a technology on GHG emissions, water use, soils and biodiversity.</p>	2019 - 4.1.2 Technology developers take environmental issues into account in their research priority setting in three countries.	Complete	<p>The tools are in use in all three countries, through trainings of partners. Evidence includes a report on refinement of the CLEANED tool and a presentation at workshop in Southern Africa.</p>	<p><a href="https://cgspace.cgiar.org/handle/10568/107020">https://cgspace.cgiar.org/handle/10568/107020</a></p> <p><a href="https://cgspace.cgiar.org/handle/10568/102368">https://cgspace.cgiar.org/handle/10568/102368</a></p>
	<p>F4 Outcome: 4.2 Targeted solutions are used by research and development partners, across at least 10 priority countries and other locations, to increase the productivity of cattle, small ruminants and pigs in the</p>	Agricultural systems diversified and intensified in ways that protect soils and water	<p>Greenhouse gas (GHG) baselines fully published in Kenya; data analysis almost complete in Tanzania; data complete in Vietnam but not published. RHoMIS (Rural Household Multi-Indicator Survey) assessments used across more than ten countries for tradeoff analysis among household objectives:</p>	2019 - 4.2.1 Novel approaches for ex-ante environmental assessment are widely adopted by extension systems, development partners and government agencies in three countries to	Complete	<p>GHG emissions baselines published. RHoMIS tool use documented and data for 13,000 households publicly available.</p>	<p><a href="https://nature.com/articles/s41597-020-0388-8">https://nature.com/articles/s41597-020-0388-8</a></p> <p>See <a href="http://www.rhomis.org">www.rhomis.org</a> for documentation of use of RHoMIS tool</p>

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	face of ongoing environmental changes.		food security, land allocation among farm enterprises, GHG emissions, income.	identify win-win options.			across multiple countries
				2019 - 4.2.2 Quantification of environmental impacts guides the development and selection of productivity-enhancing options by at least one research and development partner in three priority countries to identify win-win options	Complete	Ongoing collection of data on GHG emissions. Continued stream of publications in process.	No new publications in 2019 but several underway (Tanzania).
	F4 Outcome: 4.3 Government agencies and development partners at local and national levels across at least 10 priority countries and other locations are promoting environmental management options.	More productive and equitable management of natural resources	Results of feeding trials are now completed in Kenya with more underway. These results are applicable across East Africa. Ongoing work on pasture management in Colombia continues to show that Nitrous Oxide emissions are reduced from well-managed pastures. Rangeland management and restoration techniques are in use in Kenya, Tanzania, Ethiopia and Tunisia.	2019 - 4.3.2 Quantification of environmental benefits leads to selection and further development of management options by at least one partner in three priority countries	Complete	In 2019 we published several articles on the impacts of improved feeding regimes on GHG emissions.	<a href="https://hdl.handle.net/10568/99799">https://hdl.handle.net/10568/99799</a> <a href="https://doi.org/10.1038/s41598-018-37453-2">https://doi.org/10.1038/s41598-018-37453-2</a>
				2019 - Five sustainable rangelands interventions in Kenya, Tanzania, Tunisia and	Extended	We have produced and are disseminating guidance on	<a href="https://repo.mel.cgiar.org/handle/20.500.11766/10219">https://repo.mel.cgiar.org/handle/20.500.11766/10219</a>

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				Ethiopia are identified, tested and disseminated to livestock producers by the end of 2018.		rangeland management in Tunisia, Kenya and Ethiopia.	<a href="https://repo.mel.cgiar.org/handle/20.500.11766/10498">https://repo.mel.cgiar.org/handle/20.500.11766/10498</a> <a href="https://repo.mel.cgiar.org/handle/20.500.11766/9675">https://repo.mel.cgiar.org/handle/20.500.11766/9675</a> <a href="https://cgspace.cgiar.org/handle/10568/106543">https://cgspace.cgiar.org/handle/10568/106543</a> <a href="https://cgspace.cgiar.org/10568/106594">https://cgspace.cgiar.org/10568/106594</a>
	F4 Outcome: 4.4 Gender responsive environmental management options that are well adapted to Global Environmental Change are adopted by households (women and youth) in 6 countries.	Improved capacity of women and young people to participate in decision-making	We produced a synthesis report on best practice/ progress to date to better integrate gender concerns and make sustainable land management interventions more gender responsive. We continue to work on understanding the gender differences in participation in the Index Based Livestock Insurance Program.	2019 - Tools to enhance gender inclusion in environmental management identified: four tools identified by end of 2018 across five types of sustainable land management projects, based on a global review.	Complete	The review of gender and sustainable land management has been published and shared.	<a href="https://hdl.handle.net/10568/106538">https://hdl.handle.net/10568/106538</a>
	F4 Outcome: 4.5 National government agencies across at least 5 priority countries design and implement key policies to improve the environmental management of livestock systems	Land, water and forest degradation (Including deforestation) minimized and reversed	We continue to work with local and national government agencies in Tanzania, Ethiopia, Kenya and Tunisia to improve the governance and management of rangelands. This includes continued engagement on land policy in Tunisia; the success of Joint Village Land Use planning in	2019 - 4.5.2 National government agencies in three priority countries use flagship outputs to improve land governance arrangements, thereby	Complete	In Kenya, tools developed by ILRI are included in the national Land Commission guidelines for county spatial planning (see Innovation 1071). In Tanzania, the Joint Village Land Use Planning process has been developed with government (see	<a href="https://hdl.handle.net/10568/107388">https://hdl.handle.net/10568/107388</a> <a href="https://hdl.handle.net/10568/106344">https://hdl.handle.net/10568/106344</a> <a href="https://hdl.handle.net/10568/99262">https://hdl.handle.net/10568/99262</a>

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			Tanzania; the success of the Woreda Level Land Use Planning in Ethiopia; and the integration of land use planning for rangelands into the Kenya national land use planning guidelines.	helping to reduce land degradation.		Innovation 277). In Ethiopia, the Woreda planning was recognized by the national government (see Innovation 279).	<a href="https://livestocksystems.ilri.org/2019/10/01/fiona-flintan-recognized-by-ethiopian-government-for-contributing-to-sustainable-rangelands/">https://livestocksystems.ilri.org/2019/10/01/fiona-flintan-recognized-by-ethiopian-government-for-contributing-to-sustainable-rangelands/</a>
	F4 Outcome: 4.6 Evidence generated by the flagship influences key global livestock agendas (IPCC, Global agenda for Sustainable Livestock)	Reduced net greenhouse gas emissions from agriculture, forests and other forms of land-use (More sustainably managed agro-ecosystems)	We published a policy brief outlining our experience working with national partners on improving GHG emissions factors to attract climate finance and report on their climate change commitments under the 2015 Paris Agreement. We also attended several meetings to raise awareness of the benefits of work on improving GHG emissions from African livestock systems. This included advice to the IPCC Emission Factor Data Base in 2019.	2019 - 4.6.1 Three publications aimed at targeted global agendas developed and disseminated	Complete	A policy brief on engaging stakeholders on policies to reduce greenhouse gas emissions in the livestock sector was produced. The recognition of the data by the IPCC is an additional bonus.	<a href="https://hdl.handle.net/10568/107026">https://hdl.handle.net/10568/107026</a>
F5	F5 Outcome: 5.2 International researchers and agencies use improved livestock system modelling tools and apply them to new problems based on their mandate areas	Conducive agricultural policy environment	Progress in 2019 was mainly on strengthening the partnership with FAO and CIRAD as well as raising funds to improve the modelling at various levels, including on gender and environment aspects. While the actual modelling work is delayed, the additional resources, including the recruitment of a full time	2019 - Scenarios and modeling approaches agreed upon for integrated macro-meso analyses	Complete	Through additional support to bilateral projects (LSIL, PIM) and the use of supplemental Livestock CRP funds, progress was made towards developing conceptual frameworks and modeling approaches that integrate meso-level value chain models and macro	<a href="https://hdl.handle.net/10568/106331">https://hdl.handle.net/10568/106331</a> <a href="https://cgspace.cgiar.org/handle/10568/101979">https://cgspace.cgiar.org/handle/10568/101979</a>

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			modeller, will allow the team to deliver a more robust, user friendly and flexible sets of models, to guide policies and investment decisions. This is timely as four countries have expressed interest in developing a livestock master plan, with fund raising ongoing.			level partial equilibrium models in the context of informing livestock master plans and other livestock policy processes	
				2019 - 5.2.4 Beta version of improved models for value chain analysis and national livestock sector analysis developed for revised Livestock Sector Investment and Policy Toolkit (LSIPT)"	Extended	Reasons are twofold: one relates to modalities of working within the FAO/ CIRAD/ ILRI partnership that took more time than expected and secondly, time and expertise were spent fundraising for this work, with the work accelerating in 2020 with the addition of a full time modeller.	
	F5 Outcome: 5.3 Policy- or decision-makers in 4 countries use the packages developed and the evidence on the benefits of including gender equity considerations In the development of livestock projects and planning at community and national level (Ethiopia, Kenya, Nicaragua, Vietnam)	Gender-equitable control of productive assets and resources	Progress was made in integration of gender in the priority country programs as well as in work with technical teams, in particular health, genetics and feeds and forages. Elevating gender considerations into policies and investment decisions is done through the livestock master plans and associated modelling.	2019 - Benchmark publication on gender and livestock to identify frontiers in research and development published by December 2018.	Extended	The work has been delayed, due to competing priorities. The work is re-starting in 2020, with the help of a librarian from Cornell University and bringing in a wider team of gender and other social scientists.	

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				2019 - CRP Gender strategy published by June 2018.	Extended	While the writing of the gender strategy has been delayed due to competing priorities, the team continues to support the different flagships and country teams, to integrate gender in their work, including the assessment of gender differentiated impacts.	<a href="https://hdl.handle.net/10568/101658">https://hdl.handle.net/10568/101658</a>
	F5 Outcome: 5.4 Local or national development partners in four priority countries adopt gender-transformative and youth-supportive approaches (using the evidence from the strategic gender research done under the CRP)	Improved capacity of women and young people to participate in decision-making	The planned milestone has been delivered. The team is also testing, either as a lead or working with other organisations, different gender transformative approaches in Ethiopia, Tanzania and Ghana. This complements the gender work within the priority countries activities.	2019 - 5.4.3 1 journal article submitted entitled "A retrospective on gender empowerment"	Complete	The paper has been published	<a href="https://www.sciencedirect.com/science/article/pii/S2211912418301299">https://www.sciencedirect.com/science/article/pii/S2211912418301299</a>
	F5 Outcome: 5.6 Livestock communities across 4 priority countries apply tested technologies, management strategies and institutional arrangements, taking the multiple functions of livestock into account	Increased livelihood opportunities	A number of projects are currently testing, promoting and evaluating technologies and practices developed by Livestock CRP. For many of these more development oriented projects, however, the evidence - using rigorous methods (e.g. including control sites and households) is lacking.	2019 - 5.6.4 Livestock communities across 2 countries (Ethiopia and Kenya) apply tested technologies and management strategies based on CRP related research	Extended	In Ethiopia about 1,000 male- and 150 female-headed households apply at least one best-bet intervention (IFAD funded small ruminant project). Monitoring data are available. In Kenya, the accelerated value chain development (AVCD) project, both dairy and livestock, is also promoting	The major challenge is about the evidence as no external evaluation of these development projects has been planned.

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						technologies and practices developed by ILRI.	
	F5 Outcome: 5.7 Development partners, private sector and government agencies across 4 priority countries apply innovative institutional arrangements to enhance competitiveness and inclusiveness	Reduced market barriers	A number of projects are currently testing, promoting and evaluating institutional arrangements developed by Livestock CRP. For many of these more development oriented projects, however, the evidence - using rigorous methods (e.g. including control sites and households) is lacking.	2019 - 5.7.4 A paper on organizational and business approaches for improved dairy and small ruminant livestock value chain performance, based on field testing and impact assessment in 1 priority country	Extended	Delays have been experienced with data collection and therefore analysis. The paper will be developed as part of a special issue in Frontiers	

**Table 6: Numbers of peer-reviewed publications from current reporting period (Sphere of control)**

	Number	Percent
Peer-Reviewed publications	181	100%
Open Access	127	70%
ISI	172	95%

**Table 7: Participants in CapDev Activities**

Number of trainees	Female	Male
In short-term programs facilitated by CRP/PTF	4,279	9,209
In long-term programs facilitated by CRP/PTF	12	20
PhDs	7	5

**Table 8: Key external partnerships**

Lead FP	Brief description of partnership aims (30 words)	List of key partners in partnership. Do not use acronyms.	Main area of partnership (may choose multiple)
F1	Coordinate the baseline study, on-station and on-farm testing of ACGG strains within the country, help in organizing the innovation platforms	<ul style="list-style-type: none"> <li>• WUR - Wageningen University and Research Centre</li> <li>• PICOTEAM - PICO Eastern Africa</li> <li>• Cosmopolitan Chicken BVBA</li> <li>• EIAR - Ethiopian Institute of Agricultural Research</li> <li>• OAU - Obafemi Awolowo University</li> <li>• TALIRI - Tanzania Livestock Research Institute</li> </ul>	<ul style="list-style-type: none"> <li>• Research</li> <li>• Capacity Development</li> </ul>
F1	Providing a fully functional molecular laboratory for basic bench work, sample storage, whole genome sequencing preparation; supporting minimal bioinformatics platform; capacity building through hosting visiting scientists and students in China.	<ul style="list-style-type: none"> <li>• CAAS - Chinese Academy of Agricultural Sciences</li> </ul>	<ul style="list-style-type: none"> <li>• Research</li> <li>• Capacity Development</li> </ul>
F1	Collaborate on the African Dairy Genetics Gain Program work	<ul style="list-style-type: none"> <li>• SRUC - Scotland's Rural College</li> <li>• MoANR - Ministry of Agriculture and Natural Resources (Ethiopia)</li> <li>• TALIRI - Tanzania Livestock Research Institute</li> <li>• GDT - Green Dream TECH Ltd</li> <li>• Land O Lakes</li> <li>• Luke - Natural Resources Institute Finland (Luonnonvarakeskus)</li> <li>• UNE - University of New England</li> </ul>	<ul style="list-style-type: none"> <li>• Research</li> </ul>
F1	Field implementation of community-based breeding programs including establishment and operationalization of reproductive platforms	<ul style="list-style-type: none"> <li>• MoANR - Ministry of Agriculture and Natural Resources (Ethiopia)</li> <li>• ARARI - Amhara Regional Agricultural Research Institute</li> <li>• OARI - Oromia Agricultural Research Institute</li> <li>• TARI - Tigray Agricultural Research Institute</li> </ul>	<ul style="list-style-type: none"> <li>• Delivery</li> <li>• Research</li> </ul>

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		<ul style="list-style-type: none"> <li>• SARI - Southern Agricultural Research Institute (Ethiopia)</li> <li>• TALIRI - Tanzania Livestock Research Institute</li> </ul>	
F1	Design of breeding programs, development of database and capdev of national partners	<ul style="list-style-type: none"> <li>• EMBRAPA - Empresa Brasileira de Pesquisa Agropecuária</li> </ul>	<ul style="list-style-type: none"> <li>• Capacity Development</li> <li>• Research</li> </ul>
F1	Development of data capture and management system (AniCloud/ AniCapture	<ul style="list-style-type: none"> <li>• Abacus - Abacus Bio</li> </ul>	<ul style="list-style-type: none"> <li>• Delivery</li> <li>• Research</li> </ul>
F1	Supporting a research project on identifying the most-appropriate pig genetics for Uganda smallholder famers, including on breeding program design and pig bioinformatics	<ul style="list-style-type: none"> <li>• BOKU - University of Natural Resources and Life Sciences</li> </ul>	<ul style="list-style-type: none"> <li>• Research</li> </ul>
F1	Field implementation of research activity related to introgression of prolificacy gene and to resistance of sheep to parasites	<ul style="list-style-type: none"> <li>• INRAT - Institut National de Recherche Agronomique de Tunis</li> </ul>	<ul style="list-style-type: none"> <li>• Research</li> </ul>
F1	Supported an assessment of potential genetic interventions for large ruminants and pigs in ethnic minority communities in Vietnam	<ul style="list-style-type: none"> <li>• NIAS - National Institute of Animal Sciences</li> </ul>	<ul style="list-style-type: none"> <li>• Research</li> </ul>
F1	Partner to the Centre for Tropical Livestock Genetics and Health, undertaking livestock genomics research	<ul style="list-style-type: none"> <li>• SRUC - Scotland's Rural College</li> <li>• UNE - University of New England</li> <li>• University of Edinburgh</li> </ul>	<ul style="list-style-type: none"> <li>• Research</li> </ul>
F2	Implementing interventions to transform and strengthen the veterinary service delivery in Ethiopia by facilitating the establishment of novel service delivery models built on public-private partnerships	<ul style="list-style-type: none"> <li>• EVA - Ethiopian veterinary Association</li> </ul>	<ul style="list-style-type: none"> <li>• Delivery</li> <li>• Policy</li> </ul>
F2	Testing stationary and mobile One Health units to improve veterinary and public health services, combined with interventions to improve rangeland management, in pastoralist systems in the Horn of Africa	<ul style="list-style-type: none"> <li>• VSF-Switzerland - Vétérinaires sans Frontières - Suisse</li> </ul>	<ul style="list-style-type: none"> <li>• Delivery</li> </ul>
F2	Harmonizing approaches to understand epidemiology and impact of Peste des Petits Ruminants at regional level, jointly developing study protocol, implementing activities, and developing better PPR control strategies	<ul style="list-style-type: none"> <li>• CIRAD - Centre de coopération internationale en recherche agronomique pour le développement</li> </ul>	<ul style="list-style-type: none"> <li>• Research</li> <li>• Capacity Development</li> </ul>

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F2	Harmonizing approaches to understand epidemiology and impact of Peste des Petits Ruminants at regional level, jointly developing study protocol, implementing activities, and developing better PPR control strategies	• ISRA - Institut Senegalais de Recherche Agricole	• Research • Capacity Development
F2	Testing stationary and mobile One Health units to improve veterinary and public health services, combined with interventions to improve rangeland management, in pastoralist systems in the Horn of Africa	• CCM - Medical Collaboration Committee/Comitato Collaborazione Medica	• Delivery
F2	Harmonizing approaches to understand epidemiology and impact of Peste des Petits Ruminants at regional level, jointly developing study protocol, implementing activities, and developing better PPR control strategies	• CIRDES - Centre International de Recherche-Développement sur l'Élevage en zone Subhumide	• Research • Capacity Development
F2	Harmonizing approaches to understand epidemiology and impact of Peste des Petits Ruminants at regional level, jointly developing study protocol, implementing activities, and developing better PPR control strategies	• LCV - Central Veterinary Laboratory in Mali/Laboratoire Centrale Veterinaire au Mali	• Research • Capacity Development
F2	Creation of multi-stakeholder platforms to enhance vaccine delivery and delivery of information to livestock keepers	• VSF-Germany - Vétérinaires sans Frontières - Germany	• Delivery
F2	Characterization of circulating Peste des Petits Ruminants viruses	• FLI - Friedrich-Loeffler-Institut ( FLI )	• Research
F3	New agreement on forage breeding and germplasm evaluation for Colombia (Forage Network)	• AGROSAVIA - Corporación Colombiana de Investigación Agropecuaria	• Research
F3	New bilateral project on forage germplasm evaluation for Colombia	• GCU - Glasgow Caledonian University	• Research
F3	Forage hybrid dissemination in the global tropics and subtropics - intensification of the collaboration with the private seed sector	• Papalotla - Semillas Papalotla SA de CV	• Delivery • Research
F3	Forage seed system development for East Africa	• KIT - Royal Tropical Institute	• Delivery • Research
F3	Forage piloting and scaling in Eastern Africa	• Send a Cow • SNV - Netherlands Development Organisation	• Delivery

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		<ul style="list-style-type: none"> <li>• KALRO - Kenya Agricultural and Livestock Research Organization</li> </ul>	
F3	Engagement on silvopastoral trial and project formulation (CATIE), long-term grazing trial (INTA) and analysis/publication of grass data (UCR)	<ul style="list-style-type: none"> <li>• CATIE - Centro Agronómico Tropical de Investigación y Enseñanza</li> <li>• INTA - Instituto Nacional de Tecnología Agropecuaria</li> <li>• UCR - University of Costa Rica</li> </ul>	<ul style="list-style-type: none"> <li>• Research</li> </ul>
F3	Collaboration to implement interventions to improve women's and men's access to livestock-related extension information and adoption of these innovations	<ul style="list-style-type: none"> <li>• OEP - Office d'Elevage et des Paturages</li> </ul>	<ul style="list-style-type: none"> <li>• Capacity Development</li> </ul>
F3	Wider outscaling of proven technologies through involving grassroot organizations	<ul style="list-style-type: none"> <li>• BAIF Development Research Foundation</li> </ul>	<ul style="list-style-type: none"> <li>• Delivery</li> <li>• Capacity Development</li> <li>• Research</li> </ul>
F3	Development of sheep ration balancing tool	<ul style="list-style-type: none"> <li>• University of Nottingham</li> </ul>	<ul style="list-style-type: none"> <li>• Research</li> </ul>
F3	Evaluation of locally available sodium bentonite clay as an aflatoxin binder to reduce aflatoxin in dairy feed	<ul style="list-style-type: none"> <li>• EF - EthioFeed</li> </ul>	<ul style="list-style-type: none"> <li>• Research</li> </ul>
F3	Importation and distribution of new Kuroiler chicken lines	<ul style="list-style-type: none"> <li>• MOAIWD - Ministry of Agriculture, Irrigation and Water Development (Malawi)</li> </ul>	<ul style="list-style-type: none"> <li>• Research</li> </ul>
F3	Developing guidelines for feed and forage certification standards	<ul style="list-style-type: none"> <li>• EIAR - Ethiopian Institute of Agricultural Research</li> </ul>	<ul style="list-style-type: none"> <li>• Research</li> </ul>
F3	Identification of drought and heat stress tolerant forage cultivars	<ul style="list-style-type: none"> <li>• RDA - Rural Development Administration (Korea)</li> </ul>	<ul style="list-style-type: none"> <li>• Research</li> </ul>
F3	Molecular genetic mechanisms of drought tolerance traits in alfalfa	<ul style="list-style-type: none"> <li>• CAAS - Chinese Academy of Agricultural Sciences</li> </ul>	<ul style="list-style-type: none"> <li>• Research</li> </ul>
F5	Collaborating on development of new tools for national livestock sector analysis	<ul style="list-style-type: none"> <li>• CIRAD - Centre de coopération internationale en recherche agronomique pour le développement</li> </ul>	<ul style="list-style-type: none"> <li>• Research</li> <li>• Capacity Development</li> </ul>
F5	Collaboration for engagement and capacity building for livestock master plans	<ul style="list-style-type: none"> <li>• FAO - Food and Agriculture Organization of the United Nations</li> </ul>	<ul style="list-style-type: none"> <li>• Capacity Development</li> <li>• Policy</li> </ul>
F5	Joint work and coordination at regional level of the livestock systems innovation lab	<ul style="list-style-type: none"> <li>• UF - University of Florida</li> </ul>	<ul style="list-style-type: none"> <li>• Research</li> <li>• Delivery</li> </ul>

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F5	Global Geo-informatic Options by Context (GeOC) solutions for sustainable land management	<ul style="list-style-type: none"> <li>• WOCAT - World Overview of Conservation Approaches and Technologies</li> </ul>	<ul style="list-style-type: none"> <li>• Policy</li> </ul>
F5	Solidaridad Nicaragua is supporting the strengthening of the livestock platform in the South Caribbean Coast Autonomous Region (RACCS) to address issues of sustainability and policy related to livestock production	<ul style="list-style-type: none"> <li>• Solidaridad - Solidaridad Network</li> </ul>	<ul style="list-style-type: none"> <li>• Delivery</li> </ul>

**Table 9: Internal Cross-CGIAR Collaborations**

Brief description of the collaboration	Name(s) of collaborating CRP(s), Platform(s) or Center(s)	Value added
Research on antimicrobial resistance (AMR) under the CGIAR AMR Hub.	A4NH	Scientific
Synergies were sought with the LivestockPlus project of CCAFS in order to start a collaboration on youth capacity building for the Colombian dairy sector together with a national dairy company. In 2019, the capacity development plans were agreed and they will be executed in 2020.	CCAFS, CIAT	Efficiency: We bring together knowledge generated in both CRPs and build capacities based on it
There is a close connection with the genebank platform, with efforts currently focused on identifying key forage species for conservation and use and linkages with the update of the SoFT (Selection of Forages for the Tropics) tool. CIAT is working closely with ILRI and the Crop Trust to define a strategy for forage conservation.	CIAT, Genebank	Efficiency: linking genebank efforts with the Selection of Forages for the Tropics (SoFT) tool to be released in 2020
The relationship was formalized with ILRI entering into a 'Program Participant Agreement' with ICRISAT. In 2019 USD 80,000 was received from the CRP GLDC towards the development of dual purpose crops.	GLDC, ILRI	Scientific benefits, advancing the development of new dual purpose crop varieties
The application of genotyping-by-sequencing (GBS) was extended to assess genetic diversity in a range of ILRI forage germplasm collections, including: Napier grass ( <i>Cenchrus purpureus</i> ); Buffel grass ( <i>Cenchrus ciliaris</i> ); Rhodes grass ( <i>Chloris gayana</i> ); Lablab ( <i>Lablab purpureus</i> ); and Sesbania ( <i>Sesbania sesban</i> ). The data provide a significant resource for genetic and marker-trait association studies and genomic prediction, enhancing the prediction accuracy of superior genotypes and the efficiency of selection of new varieties, supporting improved animal production, using marker assisted breeding. Furthermore, the data support the creation of subsets which are of a manageable size and can act as reference sets for distribution and evaluation in different agro-ecologies and production systems.	Genebank, ILRI	Scientific benefits, aligned objectives to get more forages into use
The platform provides access to tools, services and best practices supporting more cost-effective generation of genotypic and phenotypic data. Also, bioinformatics tools that support automation, data integration and decision making.	EiB	Efficiency benefits, gaining access to reliable and lower-cost tools and services.

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Joint agenda setting on gender and agriculture, including livestock.	Gender	Scientific benefits; networking; fund raising
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**Table 10: Monitoring, Evaluation, Learning and Impact Assessment (MELIA)**

Studies/learning exercises planned for this year (from POWB)	Status	Type of study or activity	Description of activity / study	Links to MELIA publications
S1461 - Ex-post quantitative impact assessment of best bet sheep marketing interventions in Menz-Gishe, Ethiopia	Extended	EPIA: Ex-post Impact assessment	Best bet interventions for smart marketing (collective action and market information) were tested under the CRP Livestock and Fish and for provision of market sheds under the CRPs Livestock and Fish and PIM in the Menz sheep value chain site. Data management and analysis took longer than initially planned, but papers are being prepared on the impact of the sheds and market information; collective action did not lead to results.	
S1731 - Impact of herd health training modules in Ethiopia	Extended	Qualitative Outcome Study: (mainly to substantiate contribution to policy or similar)	Too early for some modules, good results for community conversation	
S1761 - Development of country strategies and Theories of Change for 4 CRP priority countries	Completed	Other MELIA activity	The priority country projects have all developed project proposals and theories of change (TOCs). KIT (Royal Tropical Institute) is working with the country teams to refine and test these TOCs up to the end of the CRP II period in December 2021.	
S2251 - Impact assessment of exclosure improvement in Amhara Region, Ethiopia	Cancelled	EPIA: Ex-post Impact assessment	Experimental trial plots created in 2017 under the IFAD/EC funded Drylands Restoration project led to local, up-scaling in 2018 funded by Amhara Bureau of Agriculture, with several exclosures enhanced by planting desho ( <i>Pennisetum pedicellatum</i> ) and Rhodes ( <i>Chloris gayana</i> ) grasses. Impact assessment of local up-scaling would be highly valuable for scaling the exclosure approach in the Ethiopian highlands (a widely promoted but struggling technique with high costs and little benefit to farmers). However,	

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			the restoration project ended in September 2019. An application was made to SPIA (Standing Panel on Impact Assessment) for funding support but was not approved during the year.	
S2411 - Ex-ante forage productivity, profitability and environmental impact assessments for Central America and the Caribbean	Completed	Ex-ante, baseline and/or foresight study	Participatory ex-ante productivity, profitability and environmental impact assessments were conducted with farmers and other forage value chain actors. The study covered improved grasses and other forages from the CIAT genebank.	<a href="https://hdl.handle.net/10568/106874">https://hdl.handle.net/10568/106874</a>
S2446 - The inclusion of <i>Leucaena diversifolia</i> in a Colombian beef cattle production system: An economic perspective	Completed	Other MELIA activity	<i>Leucaena diversifolia</i> is a CGIAR material from the ILRI genebank. The system evaluated also contains the CIAT Brachiaria hybrid Cayman. Peer-reviewed paper published in Tropical Grasslands-Forrajes Tropicales on "The inclusion of <i>Leucaena diversifolia</i> in a Colombian beef cattle production system: An economic perspective".	<a href="https://hdl.handle.net/10568/103608">https://hdl.handle.net/10568/103608</a>
S2455 - Impact Assessment of best-bets in the small ruminants value chain at 5 sites in Ethiopia	Extended	Program/project adoption or impact assessment	The Value Chain Assessment benchmarking was repeated in the target and control villages in five out of the seven original value chain sites in Ethiopia (selected at the start of the CRP Livestock and Fish). The report is expected in 2020.	
S2458 - Study of limitations and opportunities in the process of development, adoption and dissemination of forage technologies in Colombia	Completed	Other MELIA activity	The objective of this study was to identify limitations and opportunities in the process of development, adoption and dissemination of forage technologies in Colombia through an Agricultural Innovation System (AIS) approach. Qualitative approaches were used to analyze the processes of adoption and dissemination of forage technologies from a historical perspective, highlighting the many variables and actors involved.	<a href="https://hdl.handle.net/10568/103663">https://hdl.handle.net/10568/103663</a> <a href="https://hdl.handle.net/10568/106848">https://hdl.handle.net/10568/106848</a>
S2459 - Ex-post adoption of productivity enhancing technologies from the Accelerated Value Chain Development project in Kenya	Cancelled	Ex-post adoption study	The analysis was cancelled for 2 main reasons: the available data were found not to be appropriate for the analysis and no funds could be identified to collect additional data.	

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S2467 - Ex-post adoption of dual-purpose (feed and food) groundnut varieties in Odisha, India	Extended	Ex-post adoption study	The target variety of the study, ICGV91114 (ICRISAT), is currently being replaced as the main groundnut variety promoted by the Government of Odisha because it has reached the standard variety life of 7 years. The selection process of the replacement variety is on-going and is being documented, especially in regard to the consideration of dual-purpose characteristics. The data collection on groundnut variety adoption and groundnut haulm utilization in selected districts of Odisha is on-going and will be completed by mid-March 2020.	
S2705 - Case study of mobile animal health service delivery in extensive livestock production systems in Kenya	Completed	Program/project adoption or impact assessment	Mobile delivery of animal health services in arid and semi-arid lands (ASALs) was an innovation by ILRI. The approach was tested for feasibility with 2 different mobile service providers (one small the other large) and in three counties with varying levels of access to animal health services.	<a href="https://hdl.handle.net/10568/105579">https://hdl.handle.net/10568/105579</a>
S3095 - Ex-ante impact evaluation of the adoption of improved forage varieties in the Colombian Eastern Plains	Completed	Program/project adoption or impact assessment	<i>Brachiaria brizantha</i> 26124 is a CGIAR material from the CIAT genebank.	<a href="https://hdl.handle.net/10568/105690">https://hdl.handle.net/10568/105690</a>
S3116 - Economic evaluation of forage materials for bovine meat production systems in Colombia	Completed	Other MELIA activity	The following varieties were evaluated from an economic perspective: (i) <i>Brachiaria brizantha</i> 26124 hp. Orinoquia for meat production in the Colombian East Plains region; and ii) <i>Megathyrsus Maximus</i> cv. <i>Savannah agrosavia</i> for meat production in the Colombian humid Caribbean region. (i) is a CGIAR material from the CIAT genebank while (ii) originated in the CIAT genebank and was evaluated and released by NARS partner AGROSAVIA in cooperation with CIAT.	<a href="https://hdl.handle.net/10568/106847">https://hdl.handle.net/10568/106847</a>

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S3117 - Economic profitability study for integration of forage production in mixed crop-livestock farms in Kenya	Completed	Other MELIA activity	The evaluated materials are either from the CIAT genebank, the ILRI genebank, or CIAT hybrids. The integration is part of a CIAT German-funded East Africa project, which is mapped to the CRP Livestock Feeds and Forages flagship.	<a href="https://hdl.handle.net/10568/106912">https://hdl.handle.net/10568/106912</a>
S3183 - Upgrading the smallholder dairy value chain: A system dynamics ex-ante impact assessment in Kilosa District, Tanzania	Completed	Ex-ante, baseline and/or foresight study	The assessment looked at the ex-ante impacts of two policy interventions that improve productivity of local-breed cows, artificial insemination (AI) and producers' access to distant markets through a dairy market hub. The policy interventions were introduced under the CRP Livestock and Fish.	<a href="https://hdl.handle.net/10568/105986">https://hdl.handle.net/10568/105986</a>

**Table 11: Update on Actions Taken in Response to Relevant Evaluations**

Name of the evaluation	Recommendation number (from evaluation)	Text of recommendation (can be shortened)	Status of response to this recommendation	Concrete actions taken for this recommendation.	By whom (per action)	When (per action)	Link to evidence
N/A							

**Table 12: Examples of W1/2 Use in this reporting period (2019)**

Please give specific examples, one per row (including through set aside strategic research funds or partner funds)	Broad area of use of W1/2
Identification of candidate genes and markers associated with important forage traits in Napier grass	Research
Dissemination of information on cactus use through capacity building and media coverage	Delivery
Development of tools e.g. genderized Feed Assessment Tool (G-FEAST), Animal Feed Analysis Web Application (AFAWA) and Vegmeasure	Delivery
Assessment of constraints to and opportunities for quality forage seed supply in Ethiopia	Research
Co-development of technical baselines for sustainable cattle policy in Colombia	Partnerships
Planning and implementation of priority country projects	Research

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**Table 13: CRP Financial Report**

Flagship	Planned Budget 2019*			Actual expenditure*			Difference*			Comments
	W1/W2 US\$	W3/Bilateral US\$	Total US\$	W1/W2 US\$	W3/Bilateral US\$	Total US\$	W1/W2 US\$	W3/Bilateral US\$	Total US\$	
FP1 - Livestock Genetics	3,375,702	4,179,034	7,554,736	3,596,018	7,273,363	10,869,381	-220,316	-3,094,329	-3,314,645	-
FP2 - Livestock Health	3,539,789	1,769,999	5,309,788	3,105,872	2,574,115	5,679,987	433,917	-804,116	-370,199	-
FP3 - Livestock Feeds and Forages	2,647,500	4,621,761	7,269,261	2,633,715	3,801,968	6,435,683	13,785	819,793	833,578	-
FP4 - Livestock and the Environment	1,830,472	3,160,746	4,991,218	2,076,851	7,278,110	9,354,961	-246,379	-4,117,364	-4,363,743	In addition, ILRI contributed US\$ 193,493 Center Funds, compared to a US\$ 0 planned budget figure.
FP5 - Livestock Livelihoods and Agri-Food Systems	2,018,486	8,562,918	10,581,404	1,918,918	8,590,991	10,509,909	99,568	-28,073	71,495	In addition, ILRI contributed US\$ 118,948 Center Funds, compared to a US\$ 639,959 planned budget figure.
Strategic Competitive Research grant	1,200,000	0	1,200,000	108,453	0	108,453	1,091,547	0	1,091,547	-
CRP Management & Support Cost	2,588,051	0	2,588,051	2,532,204	0	2,532,204	54,847	0	55,847	In addition, CIAT contributed US\$ 13,897 Center Funds (for FP3 Feeds and Forages), compared to a US\$ 0 planned budget figure.
<b>CRP Total</b>	<b>17,200,000</b>	<b>22,294,458</b>	<b>39,494,458</b>	<b>15,972,031</b>	<b>29,518,547</b>	<b>45,490,578</b>	<b>1,227,969</b>	<b>-7,224,089</b>	<b>-5,996,120</b>	

## Annexes

### Table Annexes

FP	Detailed Annex
F1: Livestock Genetics	<p>Major pieces of work. The major 'lines' of work supported by the flagship are: (1) genomic selection based breeding programs for cross-bred dairy cattle, linked to natural sire and artificial insemination based delivery systems, in Tanzania and Ethiopia; (2) community based breeding programs for small ruminants, linked to natural sire and artificial insemination based delivery systems, in Tanzania and Ethiopia; (3) genetic improvement programs based on breed substitution for chickens, linked to distribution systems for the improved breeds, in Tanzania, Ethiopia and Nigeria; (4) genetic improvement strategy for pigs, linked to community based artificial insemination delivery systems, in Uganda, and (5) guidelines on policy and/or institutional arrangements for conservation and use of animal genetic resources. From this work, four OICRs have been reported in 2019: two from the small ruminant work, and one each from the chicken and dairy cattle work.</p> <p>Outcomes and milestones. The Flagship's main pieces of work described above have (or will) each contribute to all project outcomes. Specific progress in 2019 was: Towards outcome 1.1 (characterization of livestock systems for development of livestock genetic improvement strategies). Plans to establish an advanced dairy cattle research facility were abandoned due to lack of funding (milestone 1.1.5; cancelled). However excellent data on livestock systems and animal performance has, and will continue to be, accumulated through other flagship initiatives (e.g. milestone 1.1.7; ongoing) that will eventually allow for analysis similar to that planned on the research station data (though in a longer time-frame). Towards outcome 1.2 (implementation of livestock genetic improvement strategies). In relation to the dairy cattle breeding program, a genomic tool for determining parentage and breed composition has been designed (milestone 1.2.4; ongoing), and a customized breeding objective to ensure the genetically improved cattle meet the needs and preferences of the smallholder farmers identified (milestone 1.2.6; also ongoing). Towards outcome 1.3 (business models for multiplication and delivery of improved livestock genetics). In relation to the small ruminant breeding program, a network of reproductive laboratories was established in two countries, facilitating better delivery of the improved genetics (milestone 1.3.3; complete). In relation to the dairy cattle breeding program, business models for artificial insemination are being piloted in one country (milestone 1.3.4; ongoing). Whilst not listed as 2019 milestones, business models for delivery of improved chicken have been identified with private poultry companies in three countries committing to deliver more productive and resilient chicken breeds (see OICR 3297 or more details). Towards outcome 1.5 (policies and institutional arrangements supporting animal genetic resource use). In relation to the chicken genetic</p>

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	<p>improvement program, smallholder poultry platforms were established in three countries to support delivery models for improved chicken genetics (milestone 1.5.3; complete).</p> <p>Innovations. The total number of flagship innovations in 2019 was 8. Of note are: a framework for upscaling community based breeding programs (CBBPs) which has contributed to the CBBPs being upscaled in various African countries (see OICR 3269); mobile apps to formulate chicken rations from locally available ingredients, which are available for uptake in three countries; and development of the first technology for biobanking poultry breeds, is also available for uptake. In relation to the dairy cattle breeding program are two innovations: the first is a digital tool for interaction with farmers and the second is a protocol and pipeline for genomic assisted identification of genetically superior dairy cattle, that contributed to identification of genetically superior breeding animals in Tanzania. These were subsequently adopted for use by Tanzania's national artificial insemination center (see OICR 3272).</p> <p>Policies. The flagship reported four policies in 2019. Of note are investments supporting further work on chicken genetic improvement and delivery (see OICR 3297) and the incorporation of training on CBBPs into the curriculum of national Universities (see OICR 3271).</p> <p>Major course corrections. Moving forward, less emphasis will be placed on activities supporting outcome 1.5 due to the generally favourable institutional and policy environment for animal genetic resource use in the Flagship's target countries. Additionally, it is noted that the breeding program for pigs is less developed than those for other species, mainly due to lower resourcing. Efforts to secure resources for pig breeding at scale will thus be prioritized.</p> <p>Cross flagship linkages. Key cross-flagship linkages include: with the Livestock Livelihoods and Agri-food Systems Flagship on integrating of gender into flagship activities, and inclusive of the development of a framework for gender incorporation into livestock breeding programs in low and middle income countries: with the Animal Health Flagship, in relation to certification of sires in community-based breeding programs where the Animal Health Flagship contributed to developing the certification criteria; and with the Livestock and the Environment Flagship in relation to ongoing work around livestock heat-stress mapping. In addition, the Flagship has collaborated with all other flagships in relation to the CRP priority country initiatives.</p>
F2: Livestock Health	<p>Related to outcome 2.1 (health constraints and disease risk models), the evidence base on livestock disease priorities, occurrence and impact has grown considerably with 9 published papers. Also, we published a proposed risk modelling framework with risk maps and control scenario simulation model for pig diseases in Uganda. New bilateral projects (BUILD PPR and ECO-PPR), increased the flagship's visibility internationally in supporting global efforts towards eradication of <i>peste des petits ruminants</i> (PPR). Using the developed interdisciplinary PPR-toolbox allows generation of data needed to model control scenarios of eradication in high risk areas. Two papers were published on the sero and molecular prevalence of <i>toxoplasma gondii</i> and <i>neosporea caninum</i> in the semen of rams, highlighting the importance of these 2 zoonotic parasitosis in sheep flocks. The research on ticks and tick-borne diseases in sheep and dromedaries has</p>

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	<p>led to a focus on the prevalence of zoonotic viral diseases, namely the Crimean Congo hemorrhagic fever in camels and the tick-borne encephalitis in sheep. A paper was submitted describing a climate-based model for tick life cycle: an infinite system of differential equation approach. Two more papers were published on the anthelmintic effect of the chamomile methalonic extract and on the infestation of sheep by <i>Cysticercus tenuicollis</i> (larvae of <i>Taenia hydatigena</i>), a frequent cosmopolitan endoparasite.</p> <p>The work towards herd health packages to reduce the negative impact of diseases (Outcome 2.2) successfully tested multi-stakeholder platforms to discuss sustainable solutions of interventions and defining context specific intervention calendars. (i) Evaluation of the community conversation approach, first developed in 2018, provided evidence of farmer behaviour change. Two new training modules on antimicrobial use and resistance and animal welfare were added. (ii) The search for biomarkers that can discriminate between bacterial and viral ongoing infections in pigs was initiated. A number of putative “indicator” genes and reference genes were selected. Testing these on lab standards and on limited number of clinical samples were promising and following careful consideration, it was decided the project would continue in 2020. (iii) In Ethiopia, longitudinal herd health research focusing on lamb mortality/survival started in Menz province, with 150 farmers enrolled in the study. Initial findings presented in 2 posters have shown that lambs die at all ages, but most often at weaning. Fewer lamb mortalities were observed in “CRP villages” compare to other villages. (iv) In Uganda, a tool for porcine herd health management has been developed and implemented, with lack of knowledge on reproduction management, antibiotic usage, and endemic diseases identified as key production constraints. A final draft manuscript was produced in 2019 and 2 oral presentations on the topic were delivered In Ethiopia and Uganda, while the capacity development activities relating to small ruminant and pig health, respectively have been reviewed. The findings strongly endorse modalities used but suggest modifications of some and identifies a great potential for others. A draft framework for how to conduct herd health management in dairy, small ruminants and pigs has been developed and is under refinement.</p> <p>On developing vaccines and diagnostics against target diseases – ECF, ASF and CCPP (outcome 2.4): For ECF, we showed that nanoparticle antigens are superior to their soluble counterpart. In particular, the suitability of the I-53-50 particle as a generic livestock vaccine platform technology will be evaluated over the next few years. Excellent progress has been made in ASF, with the CRISPR/cas9 construction of two ASFV candidate vaccine strains and in mapping T-cell immune response in pigs to ASFV proteins in order to prioritize antigens for subunit vaccine development studies. Improvement of CCPP vaccines is limited by antigen production. We have demonstrated that this constraint can be alleviated using ILRI 181, a faster growing strain of Mccp, or by sub-cutaneous route of immunization with low doses of live wild-type ILRI181.</p> <p>On improving access to livestock health products and services (outcome 2.5): (i) Continued development of context-adapted solutions to improve access to animal health services and other inputs has contributed to significant transformation in Kenya, where policy guidelines clarifying the role of private sector in vaccine delivery were developed. Progress was also made in reviewing Kenyan veterinary laws,</p>
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	<p>which could help enhance investments in animal health delivery by both the public and private sectors. (ii) In Ethiopia, novel models of service provisions involving public and private sectors are being tested through new bilateral projects (HEAL and HEARD). Ongoing stakeholder consultation and cross-sectoral regional public-private partnership taskforces have been key. (iii) Livestock route mapping in pastoralist areas in Ethiopia provides a basis to better target animal and human health services. (iv) Eighteen ‘Animal Health Resource Centres’ were established in 3 regions in Ethiopia in efforts to strengthen extension services. (v) In Mali the success of innovation platforms in increasing community participation in control programs has led to nationwide uptake of the approach and will be tested through the new BUILD PPR Project in Uganda.</p>
F3: Livestock Feeds and Forages	<p>In 2019, the FP3 promised to achieve 14 milestones contributing to six Flagship outcomes (3.1, 3.3, 3.4, 3.5, 3.6 and 3.8) and two Sub-DOs (1.3.4 and 1.4.2) until 2022. Thirteen of the milestones were fully achieved while one was partially achieved and will be finished in 2020. The FP also achieved one extended 2018 milestone, whereas another was cancelled.</p> <p>Regarding Outcome 3.1, two milestones were fully and one partially achieved. For milestone 3.1.2, the <a href="#">FEAST</a> tool was applied in Rwanda and its genderized version G-FEAST applied in Vietnam and tested in Burkina Faso. The ration-balancing tool <a href="#">On-farm Feed Advisor</a> was applied in India and the Vegmeasure tool (for accurate measurement of vegetation on rangelands/forests) released for global use (D10498). For milestone 3.1.6, stationary NIRS equations were developed for barley, and stakeholders used NIRS facilities in India and Burkina Faso. Milestone 3.1.12 was partially achieved: The Online Journal <a href="#">TGFT</a> launched five issues, whereas the release of the new Tropical Forages (SoFT) tool was extended to 2020 (technical issues). The extended 2018 milestone on the <a href="#">AFAWA</a> tool was achieved with more than 7,500 users.</p> <p>Regarding Outcome 3.3, both milestones were achieved. For milestone 3.3.2, CIAT’s existing <i>Urochloa</i> hybrids were scaled by the private sector on at least 100,000 additional hectares in 15 countries (evidence not yet available). Advances were made on <i>Megathyrus</i> and <i>Urochloa</i> breeding where, for instance new generations of <i>Megathyrus</i> (D10511), Bh16b (D10509) and Br19 (D10514) hybrids were evaluated and developed (targeting specific production niches in LAC/EA and commercial seed production) and new approaches for eliciting earlier flowering were tested. Locations within Colombia were identified, representative of the eco-physiological conditions of Eastern Africa, to support development of <i>Urochloa</i> and <i>Megathyrus</i> hybrids for that region (D10510). Advances were made on forage data collection and evaluation using satellite and UAV images (e.g. 10506). On Napier, research advances were made, i.e. with marker assisted selection to support the development of new cultivars. Milestone 3.3.4 was achieved with 10 barley genotypes with higher biomass, higher grain yield, better tolerance to biotic and abiotic stresses disseminated to NARS partners in Morocco and India (D10530, D10531). Nine barley genotypes with superior forage production and regrowth were selected for a second year, while 28 new genotypes with superior early vigor and fodder/grain production were selected for first year field trials.</p>

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	<p>Regarding Outcome 3.4, both milestones were achieved. Two dual purpose maize hybrids bred through CIMMYT-ILRI collaboration now occupy at least 100,000 hectares (estimated by seed production/sales data) (milestone 3.4.1). For milestone 3.4.2, three new dual-purpose barley varieties were released (PL891 in India and Ramtha1 and Ghweir1 in Jordan), characterized by superior grain and biomass production and drought tolerance (Innovation 1075). Several peer-reviewed articles were published on dual-purpose rice/wheat crops.</p> <p>Regarding Outcome 3.5, both milestones were achieved. For milestone 3.5.2, feed processing options were taken up by the public and private sectors in India. Training guides on HQCP mash for Nigeria, training modules for silage and hay making and ensilaging and drying protocols were developed (D10669, D10726, D10727). A prototype of a mobile seed cleaning and treatment unit was developed, produced and used, and 20 feed grinders were distributed (with co-financing) and utilized in Tunisia (milestone 3.5.4).</p> <p>Regarding Outcome 3.6, milestone 3.6.1 was achieved: Well-adapted cactus accessions and agronomic practices were made available to 1,200 farmers in two different agro-ecological sites in India, through establishing cactus nurseries, field days and group trainings, and development of guidelines for establishing cactus plantations (e.g. D10554, D10556). The extended 2018 milestone on agronomic rangeland practices was cancelled, as this work was aligned to FP4.</p> <p>Regarding Outcome 3.8, all milestones were achieved. For milestone 3.8.2, in Tunisia, a business model for pellet/mash was tested and validated (including women and youth) and business linkages of lead seed farmers (with new seed treatment units) and small-scale famers were established (e.g. D10587). In India, forages as cash crops for women and the use of roadside grasses for fodder value chains were evaluated (D10739). Hay production as a business opportunity in Tanzania and the market potential of forage products for Kenya were evaluated (D16488). Several economic analyses provide in-depth understanding of the economic benefits of integrating improved forages into livestock systems in Latin America and Kenya (e.g. D10576, D10562). For milestone 3.8.6, four different extension approaches (including women and youth) were evaluated in Tunisia (D10593) and one for Colombia. An agreement was made to support youth training for the Colombian dairy sector in the coming years (D19005). An e-learning module was developed for Tunisia and several forage training materials for Latin America (e.g. D19001, D19002). A feeds and forages upscaling approach was developed for East Africa and cooperation with the Kenyan dairy and East African forage seed sector was established (milestone 3.8.9). The Colombian Roundtable for Sustainable Livestock is now a fully recognized national-level institution supporting the development of a policy for sustainable livestock production (milestone 3.8.14) (D10603).</p>
F4: Livestock and the Environment	<p>We made good progress towards outcome 4.1 (environmental concerns are considered in decision making across at least 10 priority countries and other locations, by national and international development partners, government agencies and extension systems, including technology developers seeking to improve cattle, small ruminant and pig production) in 2019. While we expanded the heat stress mapping to other countries, regions and species, the first preliminary results on pig heat stress in Uganda were presented at</p>

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Tropentag. On the interface with the Feeds and Forages flagship, a report on best bet forage species adaptability (D19191) and a poster on their potential role in adaptation were developed (D9990). In order to ensure reaching the 2019 milestone (Technology developers take environmental issues into account in their research priority setting in three countries), we worked with three NGOs (TreeAID, SNV and Global Biodiversity Foundation) that used the RHoMIS tool in 2019 for integral characterization and assessment of their interventions.

Under outcome 4.2 (targeted solutions are used by research and development partners, across at least 10 priority countries and other locations, to increase the productivity of cattle, small ruminants and pigs in the face of ongoing environmental changes), we disseminated a new version of the CLEANED tool as well as a training manual (D10048). More information is available on this [website](#). Through CLEANED trainings that were held in Rwanda, Tanzania, Kenya and Ethiopia and [RHoMIS](#) trainings that took place in 33 countries, we were able to exceed the target for the 2019 milestone (novel approaches for ex-ante environmental assessment are widely adopted by extension systems, development partners and government agencies in three countries to identify win-win options).

For Outcome 4.3 (government agencies and development partners at local and national levels across at least 10 priority countries and other locations are promoting environmental management options) further advancements have been made. This included the publication of new greenhouse gas emission baselines in Kenya with a diversification of systems and land use type being observed. Further research looked into the metabolic changes of animals being fed below their maintenance energy requirements and the co-benefits achieved in terms of productivity and overall animal performance when such feed deficits are overcome (D21272). We further elaborated on the potential of low emission cattle and its drawbacks and opportunities in a review paper (D21262). Additional research looked at the variety and quality of available feeds for ruminants feeding in Western Kenya (D21271). The insights of the research have been incorporated into training materials for GIZ in Western Kenya. The available documents include an updated training manual for training of trainer courses (D10015) and farmer factsheets on specific climate smart practices for reproduction and feeding management, calf rearing, disease prevention in cattle, fodder conservation, feeding of lactating cows, establishing fodder, hygienic milk production, and management and use of manure as fertilizer.

For Outcome 4.5 (national government agencies across at least 5 priority countries design and implement key policies to improve the environmental management of livestock systems), significant progress was made in 2019. Milestones planned from earlier years which had been delayed were achieved. This included publishing a synthesis of policy issues on reducing greenhouse gas emissions. CRP influence into a new national environmental policy for Tunisia was also achieved. A milestone on dissemination of manuals and tools for rangeland and land use planning processes in Tunisia, Kenya and Tanzania to community leaders, local government officials and national line ministry staff was reached. These are documented in innovations (numbers 279, 1071, 1091, and 1114). These manuals and tools in turn contributed to our surpassing of another milestone: national government agencies in priority countries using flagship outputs to improve land governance arrangements, thereby helping to reduce land degradation. The target was three countries, but this was

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	achieved in four: Kenya, Tanzania, Tunisia and Ethiopia. This is documented in four Outcome Impact Case Reports (OICRs): numbers 3091, 3108, 3115, and 3164.
F5: Livestock Livelihoods and Agri-Food Systems	<p>For cluster 1 (policies, foresight and systems analysis), work continued on both the modelling work and on influencing decision makers and investors. On modelling, progress was made on integrating livestock in system models for foresight analysis (IMPACT), value chain analysis as well as supporting the new modelling structure to be used for Livestock Master Plans (LMPs). Multifunctional contribution of livestock at the household and territorial levels was embedded in the World Bank's Livestock Sector Investment Policy Toolkit (LSIPT) and applied to Zambia. The team worked with various decision makers through the Global Livestock Advocacy for Development (GLAD) project, by collating, summarizing and making evidence available through the <a href="http://www.whylivestockmatter.org">www.whylivestockmatter.org</a> website. Through a collaboration with OIE and the Better Enforcement of Standards for Safer Trade (BESST) initiative, the team generated evidence to support trade of livestock and livestock product trade between the Horn of Africa and the Arabian Peninsula, with outputs to be finalized in 2020. Another case of policy influence relates to the analysis of socio-economic impacts of African swine fever on the pig value chain in Vietnam, at the request of FAO. A major BMGF funded project POLICIES (Policy Options for Livestock Investment, Capacity Improvement, and Equitable Solutions) was developed and funded end of 2019, that will allow the team to focus on strengthen the suite of models to be used for the future LMPs. Likewise, a new phase of the GLAD project was developed and funded in 2019, led by the ILRI Communication and Knowledge Management team. Two policies are reported under this cluster.</p> <p>Regarding cluster 2 (gender and social equity), while two milestones could not be achieved, progress was substantial in other aspects, in particular on the Women Empowerment in Livestock Index (WELI), with the tool being published and subsequently adopted by Canada's International Development Research Centre (IDRC) as part of programmes under their Livestock Vaccine Innovation Fund (LVIF) (described in the outcome story). Collaboration with other flagships continues, as described by the Livestock Genetics Flagship. In Ethiopia, the team worked on assessing gender capacity development activities, while the paper using Gennovate data on the role of livestock in women's opportunities for innovations is progressing. The ILRI gender team secured a grant from BMGF to provide a critical and deep review of the current evidence on livestock and gender as well as developing a Learning and Implementation Agenda for gender research. Also, complementing the priority country work, two bilateral projects integrating gender transformative approaches started in 2019—one on vaccine delivery systems for chicken and goats in Ghana and the other one on women in chicken business Ethiopia and Tanzania. In addition, the gender team led the consortium that developed the winning proposal for the new CGIAR GENDER platform, that is now hosted at ILRI, providing entry points to strengthen the evidence on the role of livestock development for gender equality.</p> <p>Progress on cluster 3 (Food and nutrition security through livestock) includes various engagement at international levels on the importance of animal source foods (ASFs) in diets and the role of livestock in livelihoods, the risks associated with blanket recommendation to reduce consumption of ASFs, and the negative impacts that the rise of alternative meat could have in LMICs. High</p>

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	<p>profile media engagements <b>included</b> an op-ed in the Financial Times written by the Flagship leader on the risks of alt-meats (reposted on the ILRI News page and archived on <a href="#">CGSpace</a>) and an ILRI-led blog post published in <a href="#">The Conversation</a> on February 27, 2019 in response to the EAT Lancet's new planetary diet recommendations. Work progressed on the nutrition component of the RHoMIS tool regarding validating seasonal recall data on diet diversity and food security in Vietnam and Uganda. A brief was published, through the Feed the Future Livestock System Innovation Lab (LSIL), on Rwandan government livestock asset transfer program ('Girinka') and its association with improved child nutrition.</p> <p>Finally, for cluster 4 (Integrated technologies, practices and institutions for improved livestock systems), bilateral projects in Ethiopia and Kenya continue to provide the 'live laboratories' needed to promote and evaluate CRP technologies, and while project monitoring data are available, no external evaluation of these development projects has been conducted, which delayed the completion of the associated milestone. As part of the priority country work, the value chain team is testing a market system approach in three Livestock CRP priority countries (small ruminants in Ethiopia, dairy in Tanzania and pigs in Uganda), also building on bilateral projects in Kenya and Myanmar. A farming system approach is being used in the Vietnam priority country program. A paper on policy-induced price distortions along the small ruminant value chains in Ethiopia has highlighted the high market inefficiencies in this market. The team also documented the usefulness of 'Using 'theory of change' to improve agricultural research: Recent experiences from Tanzania have been documented in a paper published in Development in Practice.</p>
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