What is your idea?

We will assess and model how agrobiodiversity within ecosystems responds to land-use change and agricultural management intensity, integrating CGIAR-wide data with the PREDICTS database and meta-analytic approach. This will transform 1) how we monitor changes in agrobiodiversity at high frequency and spatial resolution, and 2) how we use big data in the Agrobiodiversity Index, which has applications at company, country and project level.

Agrobiodiversity is a source of resilience and a cornerstone of human health, agricultural productivity and environmental sustainability. Increasing the species and genetic diversity in agricultural production areas and markets can help mitigate threats and open up new opportunities towards more sustainable food systems. Data on agrobiodiversity are, however, highly scattered, in time, location, and discipline, so it has been challenging to guide meaningful action. The meta-analytic approach of PREDICTS (Projecting Responses of Ecological Diversity In Changing Terrestrial Systems) has proven a powerful way to integrate worldwide data on local biodiversity, and to investigate and predict how biodiversity responds to land-use changes and human interventions (Newbold et al. 2015 *Nature* 520:45-50; Newbold et al. 2016 *Science* 353:288-291). In this project, we will – for the first time – adapt and apply the PREDICTS approach to multiple aspects of agricultural biodiversity, integrating CGIAR-wide data on crop and livestock species, varieties and crop wild relatives, with the PREDICTS approach and database, including land use, land-use intensity, soil and pollinator diversity, and wild biodiversity.

The hypotheses for this proposal are two-fold: **First,** adapting and applying the PREDICTS approach to agrobiodiversity will **transform how we monitor and predict changes in agrobiodiversity in response to land-use change and agricultural management**. We will target agrobiodiversity data for collation to fill regional/taxonomic gaps in the PREDICTS database and will refine measures of management practices; the PREDICTS meta-analytical and spatial modeling approach, which is proven, transparent and rigorously peer-reviewed, will then 'glue' the data together into more robust, regionally relevant models of agrobiodiversity responses to land-use pressures than have so far been possible. Integrating these models with satellite imagery will allow monitoring and prediction of agrobiodiversity change on an annual basis, at a 1x1 km^2 resolution; this will also be possible for the diversity of crop or livestock species, varieties and/or crop wild relatives. The Bioversity and PREDICTS teams started working together spontaneously during the initial phase of the Agrobiodiversity Index (2017) and thereby identified the critical innovative actions (see below) needed to really transform agrobiodiversity monitoring in production systems. **Second,** integrating the data and insights from the PREDICTS-agrobiodiversity exercise, into the Agrobiodiversity Index, will **empower companies, countries and projects, to use agrobiodiversity data in their impact assessments, decision-making and investments towards more sustainable food systems**. At least four international agri-food companies (Nestle, Syngenta, Sainsbury's, Arla Foods) and four national governments (Ethiopia, India, Italy and Peru) are on board to test and use the findings with the farmers they work with, and to include it in the live version of the Agrobiodiversity Index, which they are pioneering with support of the European Commission. In parallel, Bioversity and partners (CGIAR centers, CSIRO, WUR) are compiling agrobiodiversity data in agricultural and food systems from the peer-reviewed and grey literature, which can be integrated with the PREDICTS database.

How will you pilot it?

The implementation process is planned as follows

Six activities	Months	Budget ($)
1. Access data on agrobiodiversity and crop-wild relatives referenced in peer--reviewed literature, including additional datasets from authors	1-5	15,000
2. Meta-analysis of responses of different categories of agrobiodiversity to land-use change and farm management types along geographical, agro-ecological and demographic gradients	2-6	20,000
3. Model extrapolation based upon remote-sensed land-use datasets	5-7	20,000
4. Build in responses into land use and on-farm management components of the Agrobiodiversity Index	6-8	10,000
5. Test responses and sensitivity with data from pioneering companies and countries	7-11	20,000
6. Web-interface construction and full integration of results and tools in the agrobiodiversity index with related projects monitoring agrobiodiversity in food systems	10-12	15,000

Simon Attwood (Bioversity International), Roseline Remans (Bioversity International), Adriana De Palma (Natural History Museum, UK), Andy Purvis (Natural History Museum, UK) and a joint postdoc ($58,512.96 for 12 months) will lead and execute the work. No software costs are needed. Additional costs include open-access publication costs ($5,000), website interface construction ($15,000), and travel costs to facilitate meetings between the teams and with the pioneering partners ($21,487).

An essential database that will be generated compiles existing data from the published literature on agrobiodiversity, where multiple sampled sites differ in land use, farming system or management intensity. This will be linked to the existing PREDICTS database on wild biodiversity, land use and management. These data will be carefully curated (including curation of taxonomic names), consistent with the existing PREDICTS database with some additions (e.g., including a more refined classifications of management practices). The data will be made openly available at the end of the project, via the CGIAR, GBIF and the Natural History Museum data portal, to ensure that our outputs are transparent to policy makers, land managers and other scientists.

If the project is successful, the findings and model will become an integral part of the agrobiodiversity index, which is due to be applied with 20 countries, 20 agri-food companies, and several sustainable investors, over the next 3 to 5 years. In addition, the database, approach and model can be used by every project that aims to monitor and measure impact on agrobiodiversity. The sensitivity of the model will be further improved over time to refine estimates and projections, by giving more weight to local studies of similar systems. A web interface will make it easier for researchers around the world to contribute relevant data to further strengthen underpinning the biodiversity evidence base, as well as to estimate agrobiodiversity consequences of changing land use/ management intensity in a specific region.