THE MULTIPLE GOODS AND SERVICES *of Asian Rice Production Systems*

FAO's "Save and Grow" highlights the value of ecological approaches to food production – using land, water, biodiversity and nutrients efficiently and in ways that are regenerative, minimizing negative impacts.

CHANGING PARADIGMS OF AGRICULTURE

Beyond singular commodity outputs, farms and farming provide multiple goods and services, often beyond farm boundaries. Examples are:

- As watersheds for downstream and urban areas.
- Providing diet diversity for local populations,
- As repositories for centuries of traditional knowledge and culture.
- As contributors - positively or negatively - to the mitigation of greenhouse gases and sequestering of carbon in soils.

REGIONAL RICE INITIATIVE

FAO FIAT PANIS

YIELD GAPS AND "NATURE GAPS"

Discussions of how the world will feed itself in the future generally focus on **yield gaps:** agricultural systems that produce less food than is possible under optimal management for a given combination of crop and environment are said to exhibit a "yield gap." It is also possible to identify "nature gaps": systems that result in lower levels of ecosystem service delivery or ecological integrity than anticipated for a given combination of environment and agricultural output. In this way, it is possible to focus equally on yields and ecosystem services.

HOLISTIC SYSTEMS OF PRODUCTION

The spirit of FAO's Save and Grow and new calls for agroecological approaches move agricultural development out of a focus on singular focal areas – e.g., improved seed, pest control, water management – to solutions that integrate all components of the farming system. Core principles include maintaining soil health; recycling of biomass and nutrients; increasing biological diversity and beneficial interactions among species; and optimizing use of water, energy, nutrients, and genetic resources. Agroecological systems should be farmer-based, aiding farmers to consider interactions between the different parts of the farming system, and create positive synergies- for example, between crop residues and livestock feed, or rice mulch and natural enemy populations.

APPLICATION TO ASIAN RICE PRODUCTION SYSTEMS

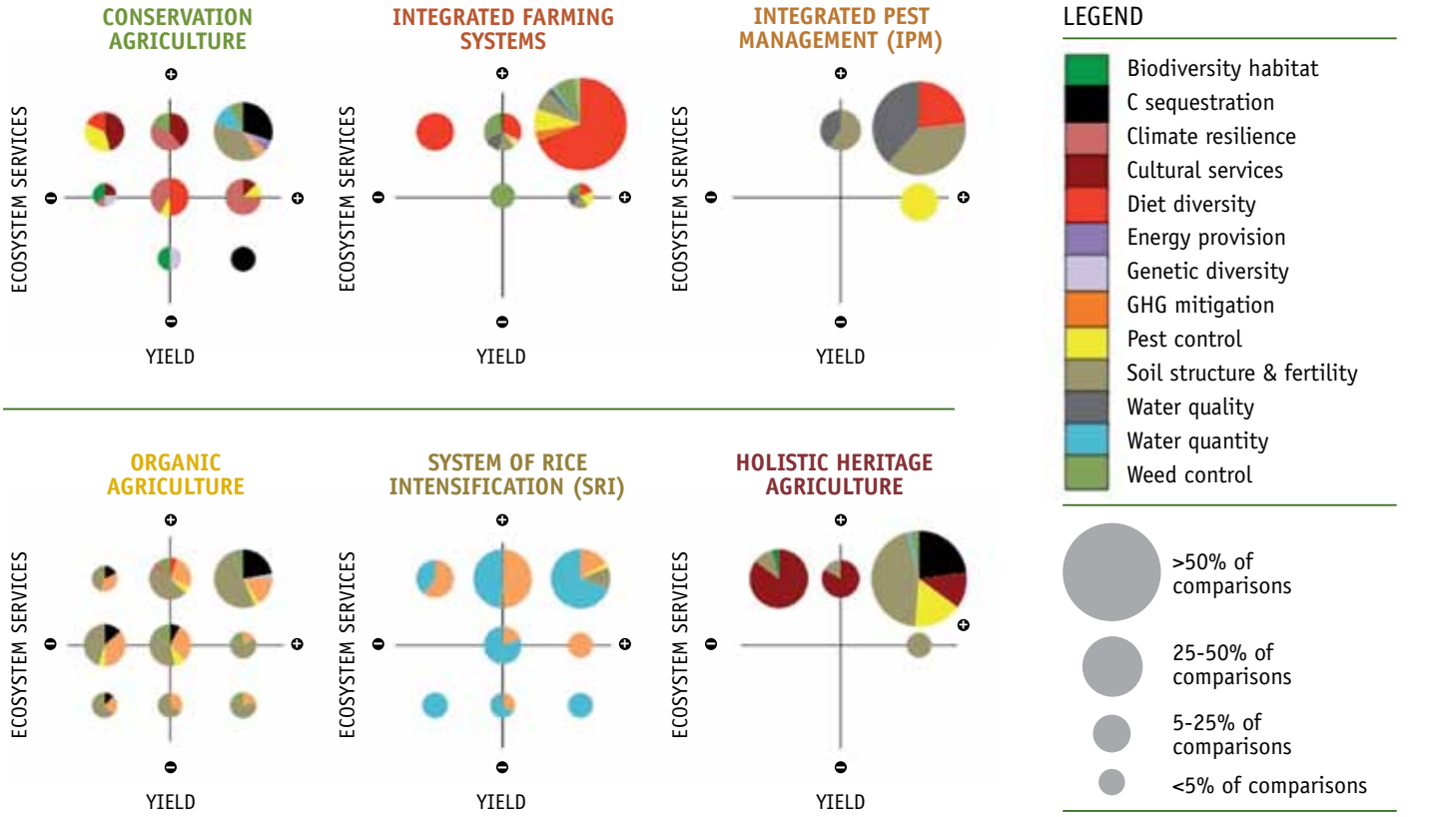
Under the Regional Rice Initiative in 2013, a process was developed to identify emerging holistic systems in rice production, review their key integral practices, and assess their documented impacts on both yields and provisioning of ecosystem services.

Development of an analytical framework

Agroecological systems in Asian Rice Production

While recognizing the multi-functionality of agricultural systems, no one system can deliver the full range of goods and services that might be envisioned as desirable. And no one system is adaptable to all agroecological zones. An assessment must encompass a range of systems, addressing multiple management

Figure 1. **Results from scoring 155 studies with 676 individual comparisons of agroecological systems (treatments) to a contrasting farming system (controls). A "vote count" method – commonly used in meta-analysis – was used to evaluate the number of comparisons presented within each study that reported outcomes for yields and the suite of 13 ecosystem services.**



objectives and agroecological zones. Through an online discussion with a set of experts in different aspects of rice production, and a workshop of national, regional and international experts held in Bali in July 2013 a set of holistic, agroecological systems applicable to Asian rice production were identified to be assessed:

1. Conservation agriculture
2. Integrated farming systems (including rice-fish or other rice-livestock-fish-tree combinations)
3. Integrated pest management (including practices involving site-specific application of inputs)
4. Organic agriculture
5. System of Rice Intensification
6. Holistic heritage systems of agriculture

Ecosystem services generated by Asian Rice Production Systems

Ecosystem services have been defined as "the benefits people obtain from ecosystems". Through an online consultation with an advisory group and an authors' workshop in Bali in July 2013, thirteen ecosystem services were highlighted as key outcomes of multi-functional rice-based agricultural systems, as indicated in the first column of Figure 2.

Assessing the Provisioning of Ecosystem Services in Rice Production Landscapes

A rigorous review of the literature – both peer-reviewed scientific papers, and grey literature including project reports and student theses – was carried out, using an agreed scoring system that noted yield differences and impacts on ecosystem services from comparison trials of agroecological systems versus conventional or traditional rice production.

Practices Integral to Agroecological approaches in Rice Production Systems

It is the set of constituent **practices** that make up any agroecological system, that farmers will need to adapt to their particular circumstances. Practices are the building blocks of exchange of information, between farmers and between trainers and farmers, and researchers. The specific practices that were central to most agro-ecological systems were identified - such as maintaining permanent soil cover, regular monitoring and informed use of inputs, and safeguarding cultural values. These can form a basis of further Save and Grow curriculum development in rice production systems, and merit further emphasis in farmer-research dialogue.

NEXT STEPS

A more detailed analysis will emerge from the dataset compiled; including more quantitative and qualitative assessment of goods and services and impacts on livelihoods. The database, and the assembled references, will be transmitted to FAO regional and national offices. Many follow-up activities are possible in the next biennium, including providing a structure for a Save and Grow on Rice, and a focus for farmer-researcher platforms. Furthermore the analysis could be useful in informing national and international policy processes related to agroecological approaches.

Figure 2. **Relationships between the six agroecological intensification systems, and the ecosystem services that they are documented to benefit, in Asian rice production systems.**

ECOSYSTEM SERVICES	Conservation agriculture	Integrated Farming System	Organic agriculture	Holistic heritage agriculture	System of rice intensification (SRI)	Integrated pest management (IPM)
Diet diversity	●	●	●	●		
Carbon sequestration	●	●	●	●		
Cultural services		●		●		
Energy provision		●				
Genetic diversity			●	●		
Mitigation of GHGs	●	●	●	●		●
Pest control		●	●	●	●	●
Soil structure, fertility, erosion control	●	●	●	●	●	●
Resilience to climate disturbance				●	●	
Water quality	●	●		●	●	
Water quantity	●			●	●	●
Weed control		●	●	●	●	
Wild biodiversity & habitat provisioning			●	●		

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