POLICY BRIEF

Smart-valleys

Working toward rice self-sufficiency in Africa in the context of climate crisis

Key points

- Smart-valleys is a simple approach to enhance farmers' resilience to drought and flooding through improved land and water management
- The approach is fully participatory, with farmers and technicians working together to adapt all the elements to the local situation
- The main components of Smart-valleys are suitable site selection, construction of drainage and irrigation infrastructure according to topological conditions and using farmers' knowledge, bunding, leveling, and integrated soil fertility management
- Adoption of Smart-valleys by West African smallholder farmers in four countries increased rice yield, income and food security
- Major enabling conditions for Smart-valleys adoption are: available inland valley land with secure farming rights and total land available. Other conditions include attractive rice market price, and farmers' experience of farming in the inland valleys, prior knowledge of Smart-valleys, membership of a farmers' association, cultivated rice area, use of compound fertilizers and tractor use
- As labor for initial construction may be a limiting factor, especially for large fields, governments, projects and NGOs could support construction costs using approaches such as food for work
- Smart-valleys needs to be integrated into national extension systems and promoted through public, private and NGO extension services to help smallholder rice farmers adapt to climate change

How can Africa become self-sufficient in rice?

Rice has become the staple food for over 750 million people in sub-Saharan Africa, but domestic production has failed to keep pace with demand. In 2020, sub-Saharan Africa produced 18.8 million tonnes (Mt) of milled rice, but still had to import 14.6 Mt to satisfy demand — at a cost of over US$ 7 billion.[1]

Inland valleys, "the upper parts of river drainage systems, comprising the whole upland–lowland continuum" excluding floodplains, are "Africa's future food baskets"[2] due to their better water availability compared with the surrounding uplands. Occupying over 190 million hectares (Mha) across the continent,[3] inland valleys have the greatest potential to fuel Africa's drive toward rice self-sufficiency. However, only about 2% of the inland valley area in sub-Saharan Africa is being used for agriculture, mainly because of poor water control.

The Smart-valleys approach

The ability to manage water supplies to fields is increasingly important to help guarantee rice production under a changing climate in which timing and amounts of rainfall are unpredictable and out-of-synch with the crop cycle.

'Smart-valleys' is a low-cost, participatory approach for land development and improved water and soil management in inland valleys. It was developed in West Africa by AfricaRice and partners, building on the Asian *sawah* system initially introduced to Ghana and Nigeria in 2004. The approach consists of three phases: selection, development and management. It begins with a site selection process based on local rice value, land tenure, market opportunity, physical accessibility, and soil and water resources. If a site is deemed suitable, development starts with farmer meetings to coordinate cooperative lowland development.

Working with field technicians, and following the lie of the land, farmers collectively design and construct a system of drainage canals, irrigation infrastructure (if there is enough water available for irrigation), and bunded and leveled fields — thereby improving water control. Combining this with other good agricultural practices (e.g. quality seed, appropriate weeding, and puddling or ponding to reduce weeds), farmers can provide optimum crop management throughout the season.

Smart-valleys is amenable to implementation within a single season, from raising awareness among farmers, through land clearance and system design, to construction and implementation.

West Africa is ideally suited for Smart-valleys: it has abundant available inland valleys (only 10–25% of which are used for rice cultivation). As early as 2011, it was estimated that development of just 20 Mha of inland valleys with Smart-valleys could provide enough rice to feed 300 million people.

Better for the environment

Smart-valleys works with the environment. The construction follows natural features such as existing drainage routes, with some pre-existing vegetation retained (e.g. on the uplands and slopes, and trees) to preserve some diversity and minimize erosion. A primary environmental concern in agriculture is poisoning via mineral fertilizers and toxic pesticides. Today, Smart-valleys promotes the combined use of organic inputs in the form of food or forage legumes grown in the valley fringes (the hydromorphic zone) both before and after the rice season, and inorganic fertilizer to enhance nutrient use efficiency. Where pesticides are deemed necessary, Smart-valleys promotes the use of natural products (e.g. neem extract) and only if really necessary the least toxic pesticides available (e.g. organophosphates rather than the long-lasting and highly toxic organochlorates used for cotton).

More rice, more cash, better food security and enhanced resilience to climate change

When a country or subnational region decides to adopt Smart-valleys, computer spatial models can be used to identify suitable inland valleys on a national or regional scale. Inland valleys have high agricultural potential, but also provide a variety of market and non-market goods and services known as ecosystem services, from which local communities benefit. Careful site selection is therefore critical to reconcile agricultural development with biodiversity and ecosystem service provision. Once suitable inland valleys have been identified, the early stages of Smart-valleys development are quite easy and involve farmers throughout the process.

Smart-valleys has been adopted in six countries: Benin, Burkina Faso, Liberia, Nigeria, Sierra Leone and Togo. From 2014 to 2020, the number of Smart-valleys sites increased from 139 to 241, the total area covered from 474 ha to 1615 ha, and the number of beneficiaries from 1486 to 14,027 rice farmers. More than 60% of the adopters are women.

While more than doubling of yield prompted the initial out-scaling, solid, long-term evidence needs to come from formal impact assessment. Three impact studies have been conducted on Smart-valleys: one involving 590 rice-farming households in Benin and Togo in 2012–2014, one using 4 years of household survey data from central Benin for 2013–2016 combined with 30 years' rainfall data at village level, and one involving 641 households in Liberia and Sierra Leone.

While 'classic' dissemination routes (involving field technicians and lead farmers) dominated in the early, 'project' phases of introduction, ongoing expansion (scaling out) depends on 'scaling partners' driving adoption. For example, in Benin, this is through development agencies and NGOs, while in Burkina Faso, post-project dissemination is by international NGO Rikolto International.

The primary factors influencing farmers' decisions to adopt Smart-valleys were having available inland valley land with secure farming rights and total land area available. Other factors were country-specific: production in the inland valleys and market price of paddy in Benin and Togo; and prior knowledge of Smart-valleys, membership of a farmers' association, rice area, use of compound (NPK) fertilizer and use of a tractor in Liberia and Sierra Leone.

For households in Benin and Togo, adoption of Smart-valleys increased yield by an average of 0.92 tonnes per hectare, income by $267 per hectare, and food security by more than 10 points on the Food Consumption Score.[4] While in Liberia and Sierra Leone, the figures were 1.32 t/ha, $440/ha and 4 points, respectively.

Next steps

Smart-valleys is easy to establish and increases yield, income and food security. Widescale diffusion of the approach would help smallholder rice farmers to adapt to climate change — better able to manage increasing droughts and floods.

We urge national and local governments in sub-Saharan Africa to adopt Smart-valleys to help rice farmers adapt to climate change, and that they encourage promotion of the approach through public, private and NGO extension services. They should also consider supporting the initial construction costs through schemes such as food for work.

One ongoing issue is that of tropical diseases with water-borne vectors, especially malaria and schistosomiasis/bilharzia, which tend to increase rapidly when standing water becomes available for any length of time (e.g. ponded or puddled rice fields). By enabling irrigation and drainage of rice fields when needed, Smart-valleys reduces the risk of long-term standing water and can reduce the density of malaria vectors. Further research is required to shed light on Smart-valleys and malaria and bilharzia transmission potential.

Background information and further reading

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Endnotes

1 United States Department of Agriculture (USDA) data and calculations therefrom.
2 Rodenburg J. 2013. Inland valleys: Africa's future food baskets. In: Wopereis MCS, Johnson DE, Ahmadi N, Tollens E and Jalloh A eds. *Realizing Africa's rice promise*. CAB International, Wallingford, UK. https://doi.org/10.1079/9781845938123.0276
3 "Based on FAO [Food and Agriculture Organization of the United Nations] and national databases, in particular FAO TERRASTAT (2003)" (Rodenburg, 2013).
4 The Food Consumption Score is a composite indicator developed by the World Food Programme (WFP). It is usually calculated to take into account dietary diversity, frequency and relative nutritional intake of foods and food groups consumed by a given household.

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