Food and Agriculture Organization of the United Nations

WORLD BANK GROUP
Environmental & Natural Resources

Aquaculture zoning, site selection and area management under the ecosystem approach to aquaculture

Photo credit: Aqualine and Yngvar Olsen

Policy Brief

The selection of the spatial area designated for aquaculture development and careful selection of farm sites are essential first steps to ensure the success and sustainability of aquaculture. They should be carried out in accordance with the Code of Conduct for Responsible Fisheries, (CCRF)[1] and the Ecosystem Approach to Aquaculture (EAA)[2]

1. The issues

There are several problems associated with spatially unplanned aquaculture development. However, the same problems present opportunities by implementing a spatial planning process under an ecosystems approach to aquaculture that ensures its orderly development and promotes its sustainability (Table 1).

2. Approach

Spatial planning for aquaculture zoning, site selection and the design of aquaculture management areas should consider the social, economic, environmental and governance objectives of sustainable development. This is especially relevant when aquaculture takes place in common properties such as shared water resources.

The CCRF encourages the concept of sustainability in aquaculture planning and management. It urges States to produce and regularly update aquaculture development strategies and plans to ensure that aquaculture development is ecologically sustainable and enables the rational use of resources shared by aquaculture and other activities.

The EAA develops these concepts into a strategy that integrates aquaculture into the wider ecosystem.[3] Embedded in the planning process are three principles of EAA:

i. Aquaculture should be developed in the context of ecosystem functions and services (including biodiversity) with no degradation of these beyond their resilience.
ii. Aquaculture should improve human-wellbeing with equity (e.g. access rights, and fair share of incomes) for all relevant stakeholders.
iii. Aquaculture should be developed in the context of other sectors, policies and goals as appropriate.

The process of spatial planning usually consists of three steps: (i) aquaculture zoning, (ii) site selection and (iii) aquaculture management areas or AMAs. The EAA offers an appropriate framework to develop management plans for AMAs that go beyond the individual farms.

Aquaculture zoning

An aquaculture zone consists of a hydrological system which is suitable for aquaculture that encompasses part of or an entire catchment area from the source of a waterway to the estuary, water body (lake or dam), coastal area, or off the coast area, that has been allocated to develop aquaculture.

1 FAO. 2011. Code of Conduct for Responsible Fisheries. [Includes a CD-ROM]. Rome, FAO. 91 pp. (also available at www.fao.org/docrep/013/i1900e/i1900e00.htm).

2 FAO. 2010. Aquaculture development. 4. Ecosystem approach to aquaculture. FAO Technical Guidelines for Responsible Fisheries. No. 5, Suppl. 4. Rome, FAO. 53 pp. (also available at www.fao.org/docrep/013/i1750e/i1750e00.htm).

3 The EAA is not new, specifically being integrated within the Convention on Biological Diversity the Ecosystem Approach (EA) defined as a strategy for the integrated management of land, water and living resources that promotes increase fish as food, conservation and sustainable use in an equitable way. Defining EA approaches to spatial planning is, however, a more recent development of the overall EAA approach.

Table 1. Common problems due to the lack of spatial planning and management of aquaculture, and opportunities through aquaculture zoning and area management

Problems	Opportunities
Fish disease and lack of effective biosecurity e.g. when farms are too close to each other.	• Minimizing fish disease risks and better response to outbreaks.
Environmental issues such as eutrophication; biodiversity and ecosystem service loses, e.g. when there are too many farms in a given area/water body.	• Better coordinated and integrated approaches to the use and management of natural resources. • Better understanding of cumulative and combined environmental effects and of interactions between users and the environment.
Production issues such as lower growth and biomass of filter feeders (e.g. oysters, mussels) due excessive farming density and overharvesting of common pool microalgae.	• Improved filter-feeders productivity and yield.
Social conflicts, equity issues and lack of public confidence in the sustainability of aquaculture; e.g. when aquaculture is competing with other users for access to water and space use.	• Improved accountability and transparency through relevant stakeholder involvement at all levels.
Post-harvest and marketing issues; e.g. when individual neighbor farmers do not have access to postharvest services.	• Clusters of farmers having better access to common postharvest processes and other services. • Area-based management and certification as a governance and risk-sharing model for sustainable aquaculture.
Risk financing. National governments and financing institutions do not have a good knowledge of where the prospects for aquaculture development are most promising before committing resources to development.	• National-level information on areas available to invest on aquaculture. • Implementing area-based management strategies (e.g. clusters of farmers) to facilitate access to finance.
Lack of resilience to climatic variability, climate change and other external threats and disasters e.g. hurricanes, tsunamis, drought, and industrial pollution of water sources.	• A more resilient sector, better adapted to shocks. • More effective mechanisms for governments and other institutions including civil society organizations to deliver services and fulfill their commitments to sustainable aquaculture development.

The creation of zones facilitates the integration of aquaculture activities into broader areas designated to other uses. It contributes to better coordination among the public agencies involved in aquaculture licensing and monitoring processes and facilitates collective action and joint management by nearby producers. Zones require prudent observation so as to avoid disease and environmental pollution through over concentrated development.

The zoning process is normally led by national or local governments with important stakeholder participation, fed by relevant information and supported by relevant regulations.

Individual site selection

Site selection is based on the suitability for development of a given aquaculture activity, taking into account the physical factors of the environment and the farming system. Site selection depends on the species to be cultured, technology to be used, type of culture system to be adopted, the location and interactions between the systems, and the surrounding environment. Decisions on site selection are usually made on an individual basis in response to applications for tenure.

This process is normally led by the private sector. The Government assists with clear regulations for the process and requirements for site licensing. Site selection process and formal site allocation are generally well regulated and, in most aquaculture producer countries, follow a process established by norms. An Environmental Impact Assessment (EIA) is usually needed, especially for larger scale industrial aquaculture. The process, however, may ignore potential accumulative effects from nearby farms or other sources.

Aquaculture management areas

Aquaculture management areas (AMAs), can be aquaculture parks, aquaculture clusters or any aquaculture area within a zone where farms share a common waterbody or water source and that may benefit from a common management system aimed at minimizing environmental, social and fish health risks (Figures 1 and 2). AMAs can also be quite beneficial for groups of small farmers seeking joint access to feed, seed, technical support services, markets and postharvest services. Where size and connectivity among farms indicate, an entire aquaculture zone can be designated as a single AMA.

The designation of an AMA relies on spatial risk assessment where the understanding of physical factors such as water flow, depth, currents and the ability of the ecosystem to absorb organic matter determine biosecurity conditions and environmental health. Provision of services to farmers, access to markets and, very importantly, conflict resolution with other users of common resources (e.g. with fisheries and agriculture) are important considerations in the designation of AMAs.

Numerous small scale aquaculture units can have a significant collective impact on the recipient water body so that strategic environmental management is needed, potentially in the form of a joint EIA or Strategic Environmental Impact Assessment (SEIA) for all concerned farms.

The need to develop biosecurity management plans is especially relevant to AMAs where farms are close together and/or connected by water flow or currents.

AMAs require an administrative structure and a management system that includes setting limits to the maximum production per area according to carrying capacity, distance among the farms, and density of fish within farms. Such a system should include monitoring and remedial action plans for environmental quality, fish health, and other relevant parameters. The definition/creation of AMAs could be a significant step forward to the sustainable intensification of aquaculture especially in regions where the farms are already operating and having difficulty with diseases and/or negative environmental impacts. AMAs also offer an opportunity for collective certification of products under an ecosystem perspective.

3. The EAA as main framework supporting the planning and management process

The process for zoning, site selection and for the design and management of aquaculture areas consists of the following main elements (following the EAA process and steps):

i. scoping to understand the broader issues in the multi-stakeholder context in which aquaculture might develop.
ii. identification of opportunities and assessment of main risks with special consideration to fish disease and environmental issues.

Figure 1. *Schematic figure of a designated aquaculture zone (hatched area in blue color) representing an estuary and the adjacent coastal marine area. Individual farms/sites (F) owned by different farmers, are presented in different colors. Four clusters of farms illustrate examples of aquaculture management areas (AMAs), grouped according to a set of criteria that include risks and opportunities.*

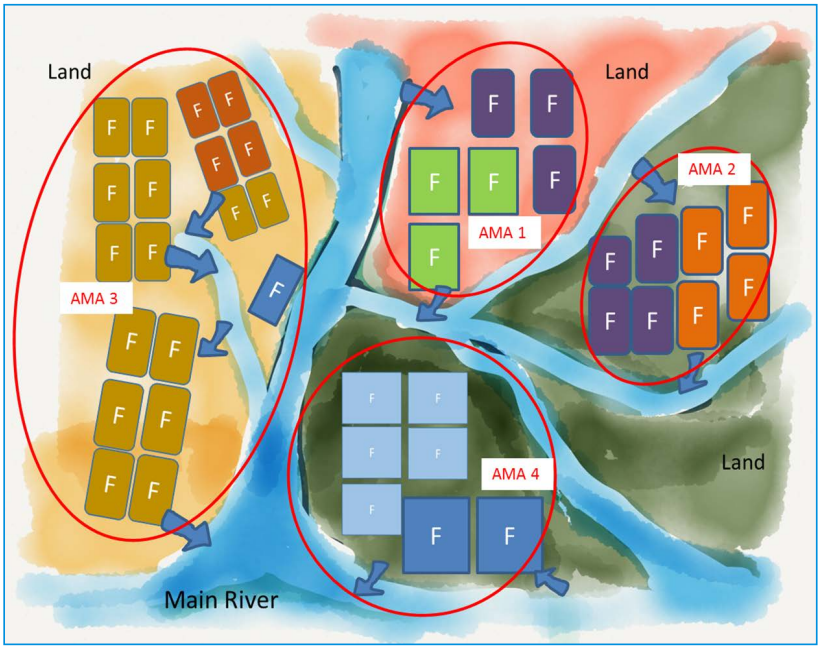

Figure 2. *Schematic figure of an existing aquaculture zone (the whole depicted area), representing individual land-based farms (F), e.g. catfish ponds, that may be owned by different farmers (presented in different colors). In this example, there are four aquaculture management areas (AMAs). The common water sources and water flow (arrows) could be the priority criteria (e.g. addressing fish health and environmental risks) to set boundaries of the AMAs.*

iii. carrying capacity estimation to determine maximum production allowed in a given area.
iv. allocation of user/area access and/or management rights.
v. develop of management plans for the zone/site/AMA.
vi. monitoring of the plan and adjustment over time.

These should include appropriate stakeholder participation with attention to gender and use of all available information including local knowledge. These can be further developed into more detailed process and components drawing on a range of associated activities and tools according to local circumstances and the scope of the work.

Spatial tools, including geographic information systems (GIS), remote sensing and mapping are essential elements to support the spatial planning and management process for data management, analysis, modelling and decision-making.

4. Policy support needed

A strategy under the framework of EEA is recommended, which comprises three interlinked processes: zoning, site selection and area management.[4] The strategy needs adequate and appropriate policy measures for effective execution. The major areas for policy support include:

1. Facilitation and promotion of adequate norms and regulations.

2. Capacity at local, provincial/state and national levels for EAA:
   – Awareness and training in the key concepts – EAA, carrying capacity, biosecurity,
   – Training in the methodologies for zoning, site selection and determination of carrying capacities,
   – Enabling stakeholders' participation in planning, conflict avoidance and conflict resolution.

3. Capacity building for farming communities to develop and successfully maintain AMAs:
   – Formation and professionalization of farmer associations,
   – Facilitating group action - adoption of better management practices, certification standards, marketing.

4. Incentives and disincentives:
   – Incentives for establishment of farms in designated zones and sites,
   – Incentives for participation in and compliance with area management protocols and arrangements: i.e. environmentally sound and socially responsible practices, biosecurity, joining the association,
   – Disincentives for non compliance with above,
   – Disincentives for opportunistic behavior - i.e. free-riding, rent-seeking.

5. Support services and measures:
   – Technology and tools (e.g. GIS, remote sensing and carrying capacity models)
   – Extension,
   – Financial - credit, co-financing,
   – Risk management - avoidance, reduction of impacts, mitigation of impacts, coping with impacts, transfer.

Implementation of aquaculture spatial planning and management requires appropriate regulations, including those that facilitate the shared access and use of water resources and coastal zones.

The spatial planning process and development of area management plans should be participatory, exploiting the best available knowledge, which must include local interests and stakeholders as appropriate.

Although generally easier where aquaculture is being newly planned, the spatial planning and area management process under the EAA can also be implemented in areas where aquaculture has already been developed, focusing on the design of AMAs and development of appropriate management plans for these. Such area management provides the opportunity to improve environmental performance, reduce risks including those related to fish disease and climate change and improve social benefits from aquaculture.

4 This policy brief is based on a long participatory process with the contributions of scientists, managers, and development practitioners in aquaculture and allied fields from academic institutions, Research and Development organizations, non-government organizations, and government development agencies and regulatory bodies from developed and developing countries in Africa, Asia, Near East, North America, South America, and Europe. Other related technical documents and manuals are also being prepared.

CONTACT

Doris Soto – doris.soto@fao.org
José Aguilar Manjarrez – jose.aguilarmanjarrez@fao.org
Fisheries and Aquaculture Department
Food and Agriculture Organization of the United Nations (FAO)
Rome, Italy

Randall Brummett – rbrummett@worldbank.org
Environment and Natural Resources
World Bank
Washington, DC. United States of America

I5004E/1/09.15