FARMING SYSTEMS

4. Livestock Systems – 4

Integrated Aquaculture

Faculty of Agriculture and Horticulture
Livestock Ecology Section
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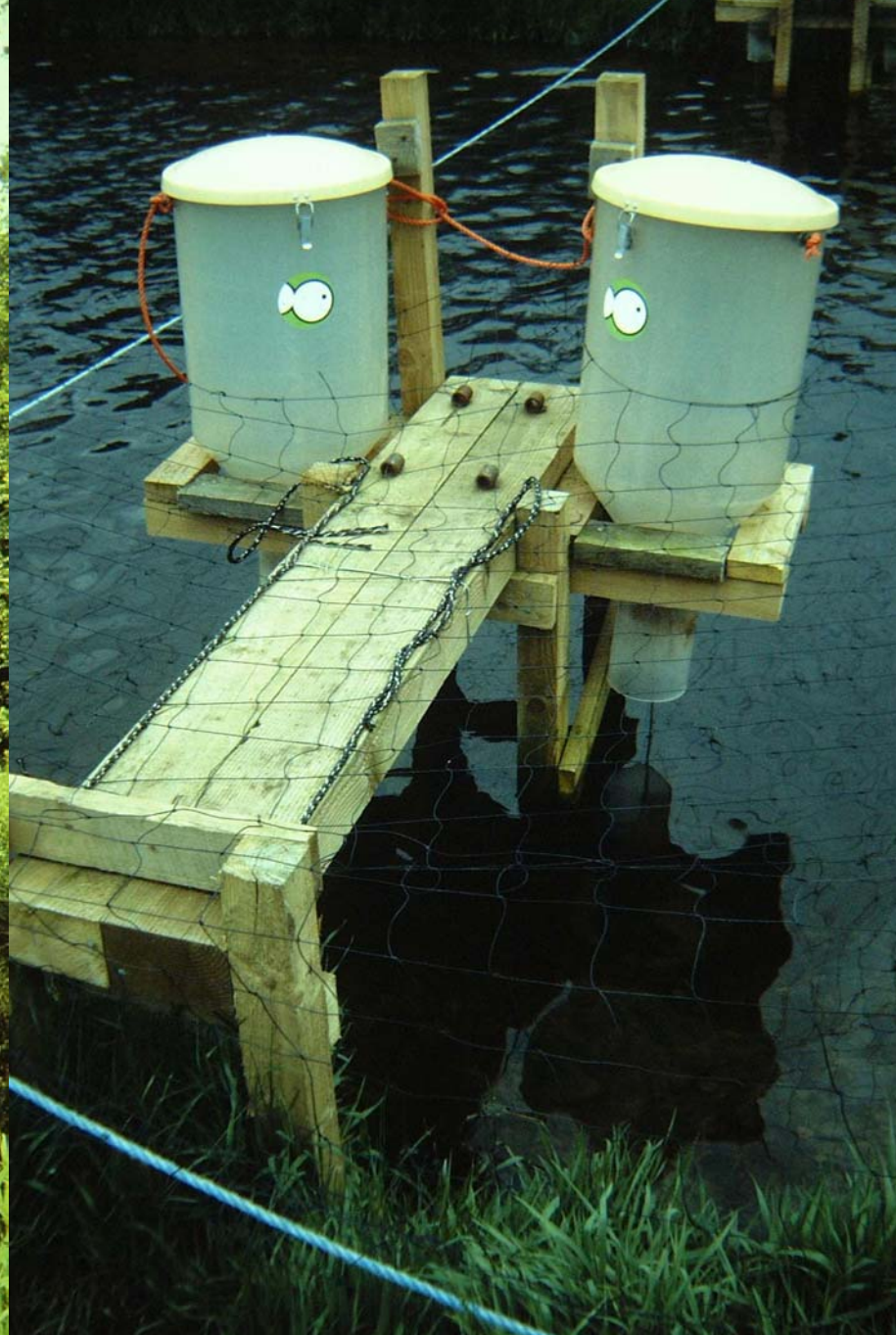
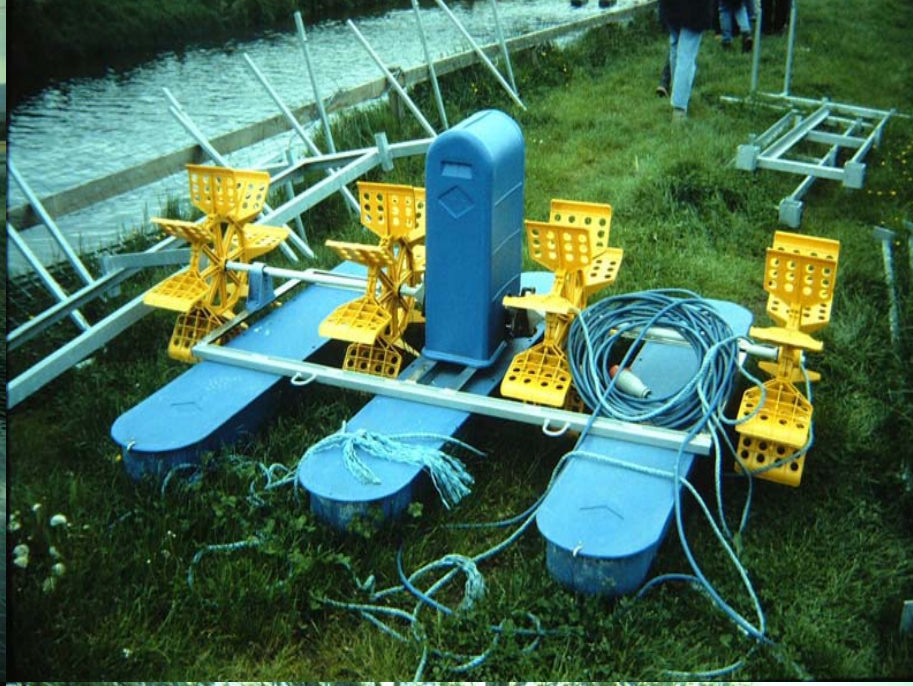
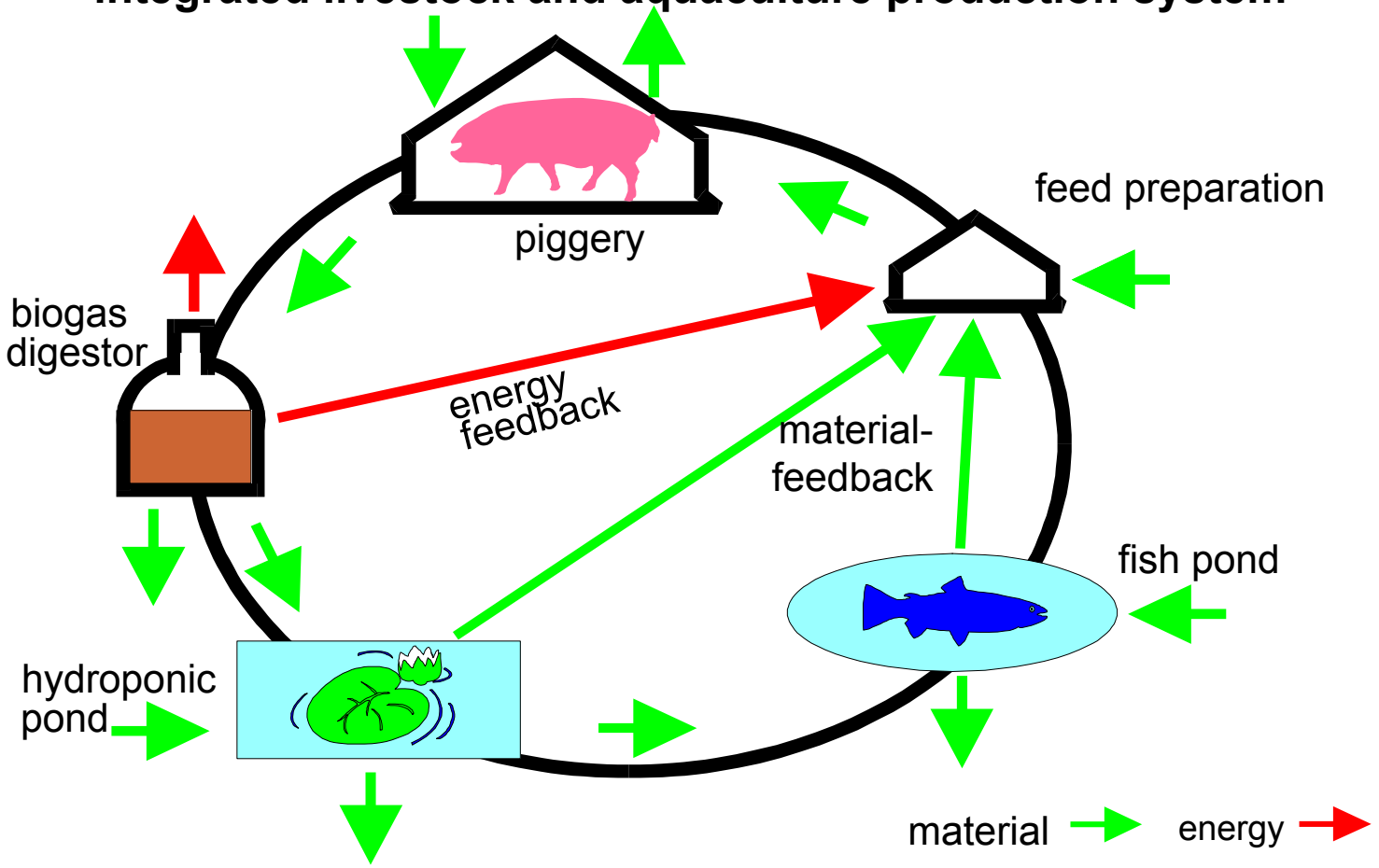
Aquaculture is the cultivation of plants and/or the systematic breeding of animals in water. This can be sweet water or sea water and can take place in natural water bodies or in man-made containers. Fishing or harvesting plants or animals from wild populations is not considered aquaculture.





Integrated systems consist of subsystems linked through mutual input-output exchanges. Integrated aqua-culture serves as a sink for by-products of other production systems and provides outputs which in turn are recycled back into the previous system or are sunk to another system level.

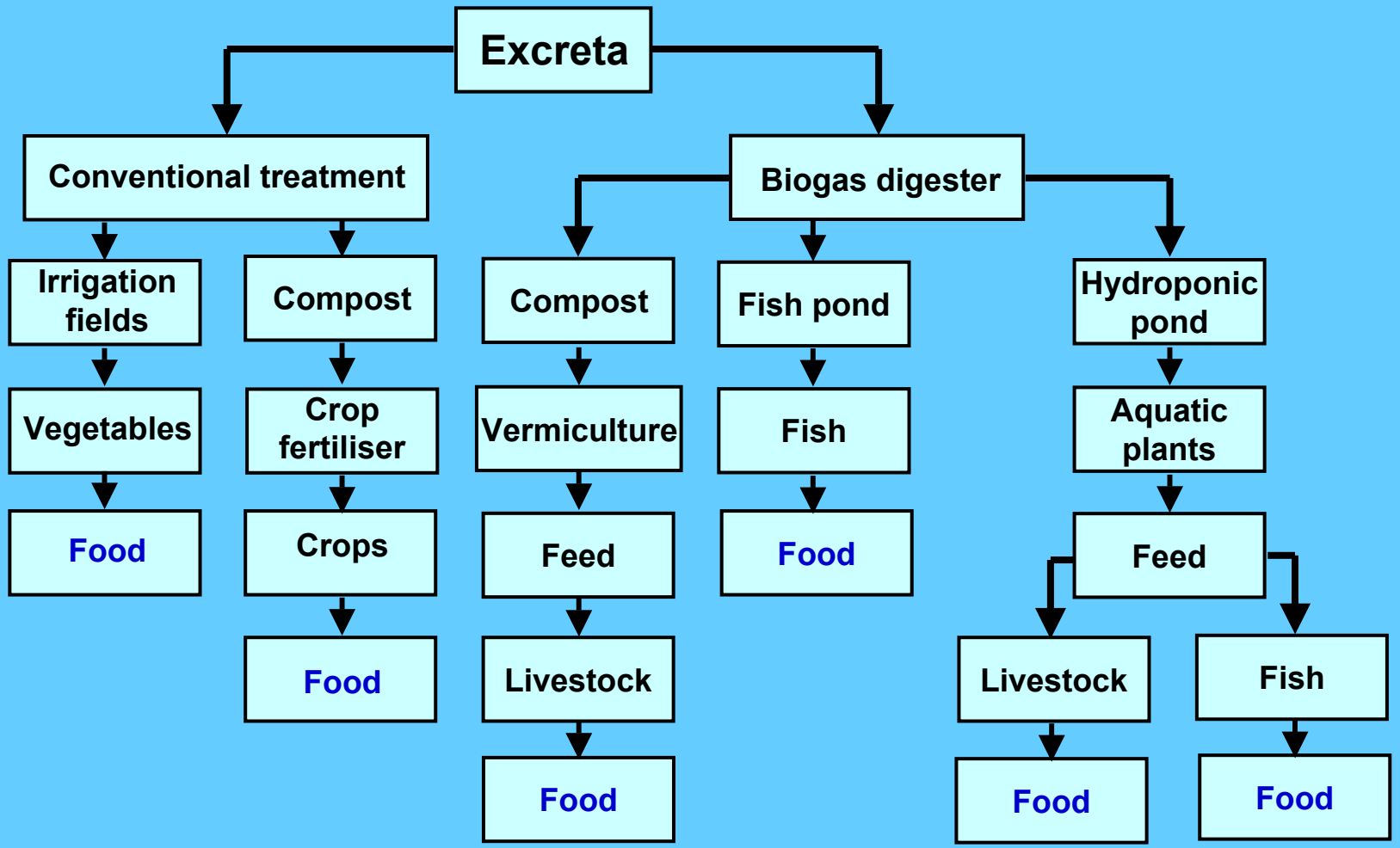
Schematic presentation of material and energy flows in an integrated livestock and aquaculture production system



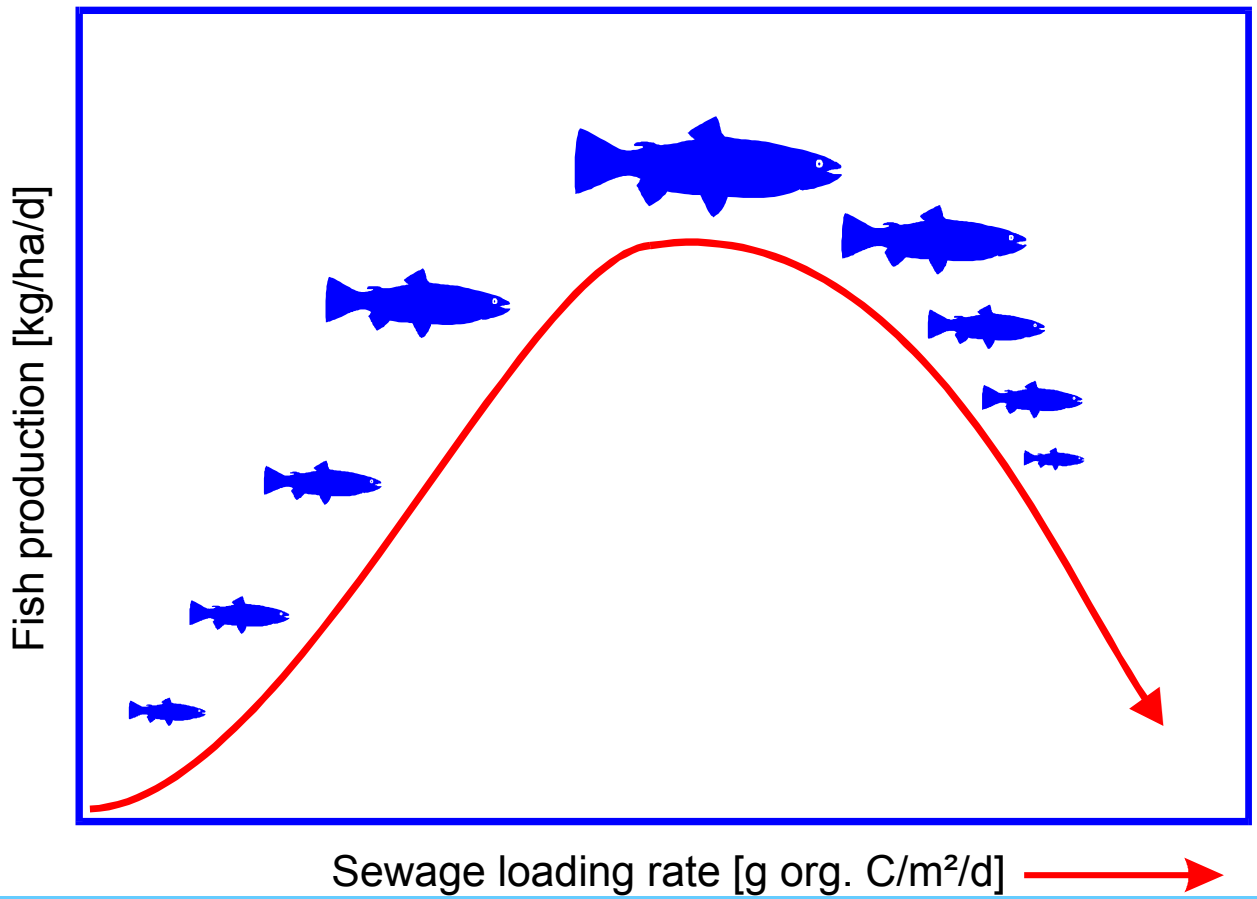
Potential roles of integrated aquaculture within a farming system

1. Waste water purification
2. Nutrient recycling
3. Energy recovery
4. Weed and pest control
5. Improving soil fertility
6. Intensification

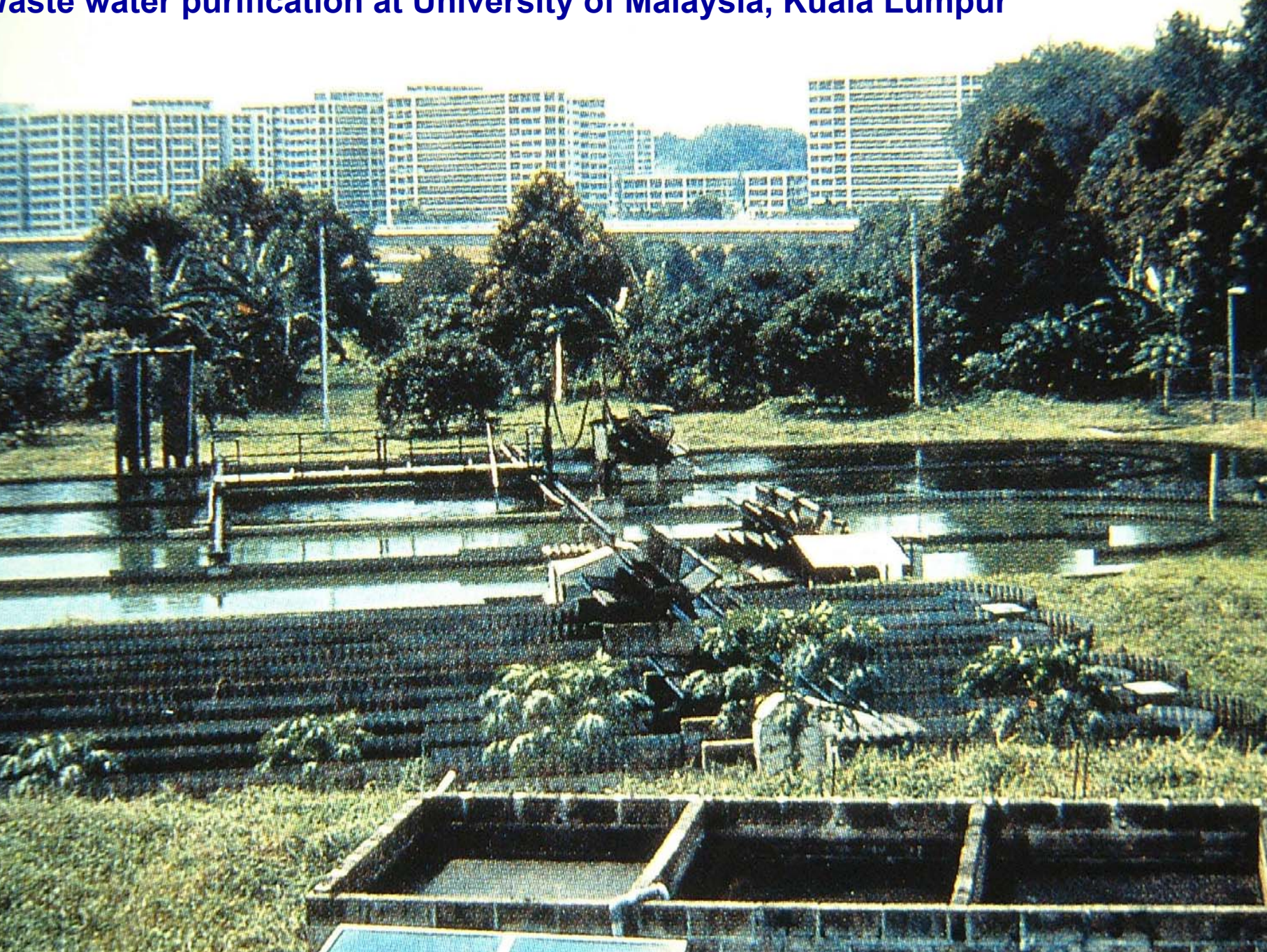
Various pathways for recycling of human and animal excreta



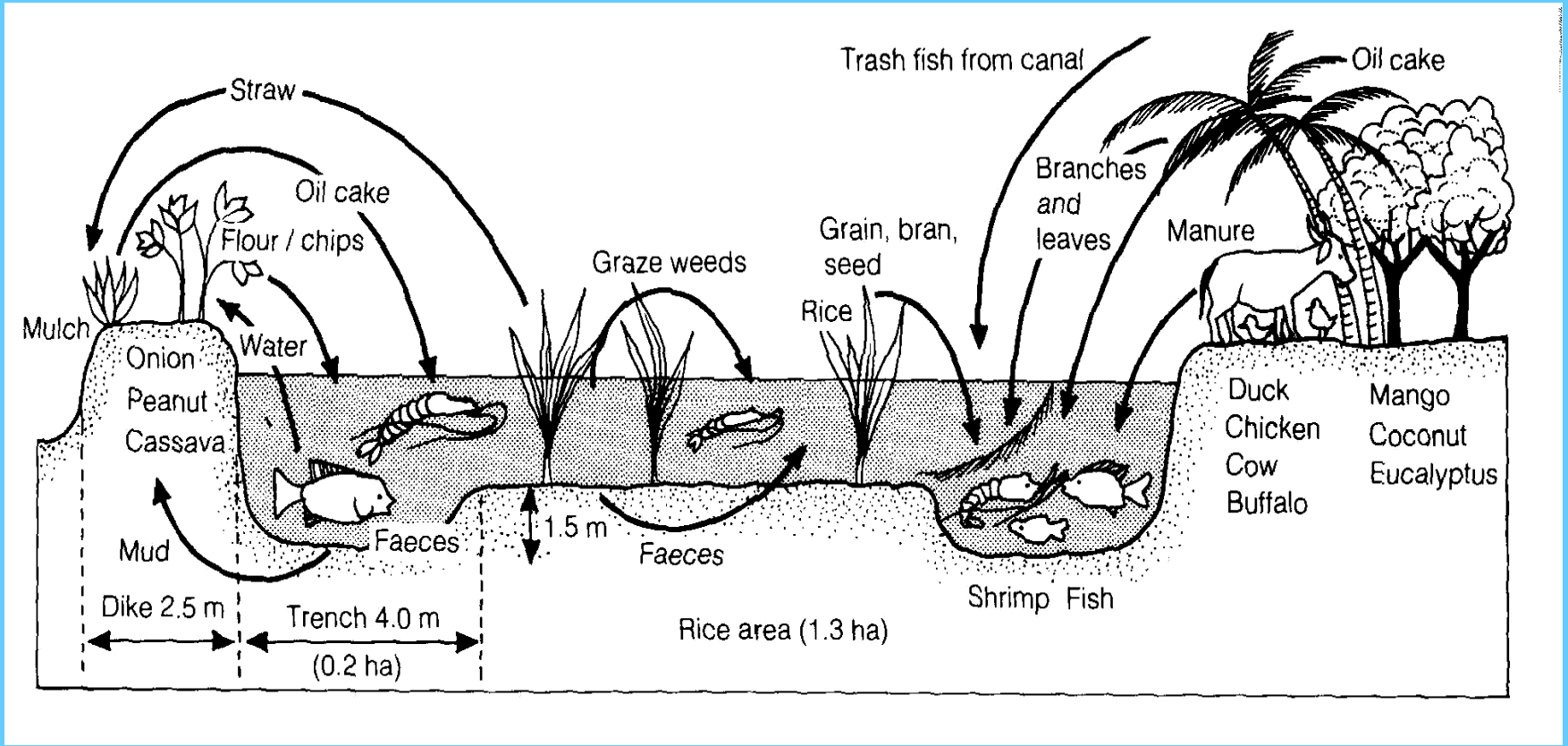
General relation between sewage loading rate and fish production



Waste water purification at University of Malaysia, Kuala Lumpur

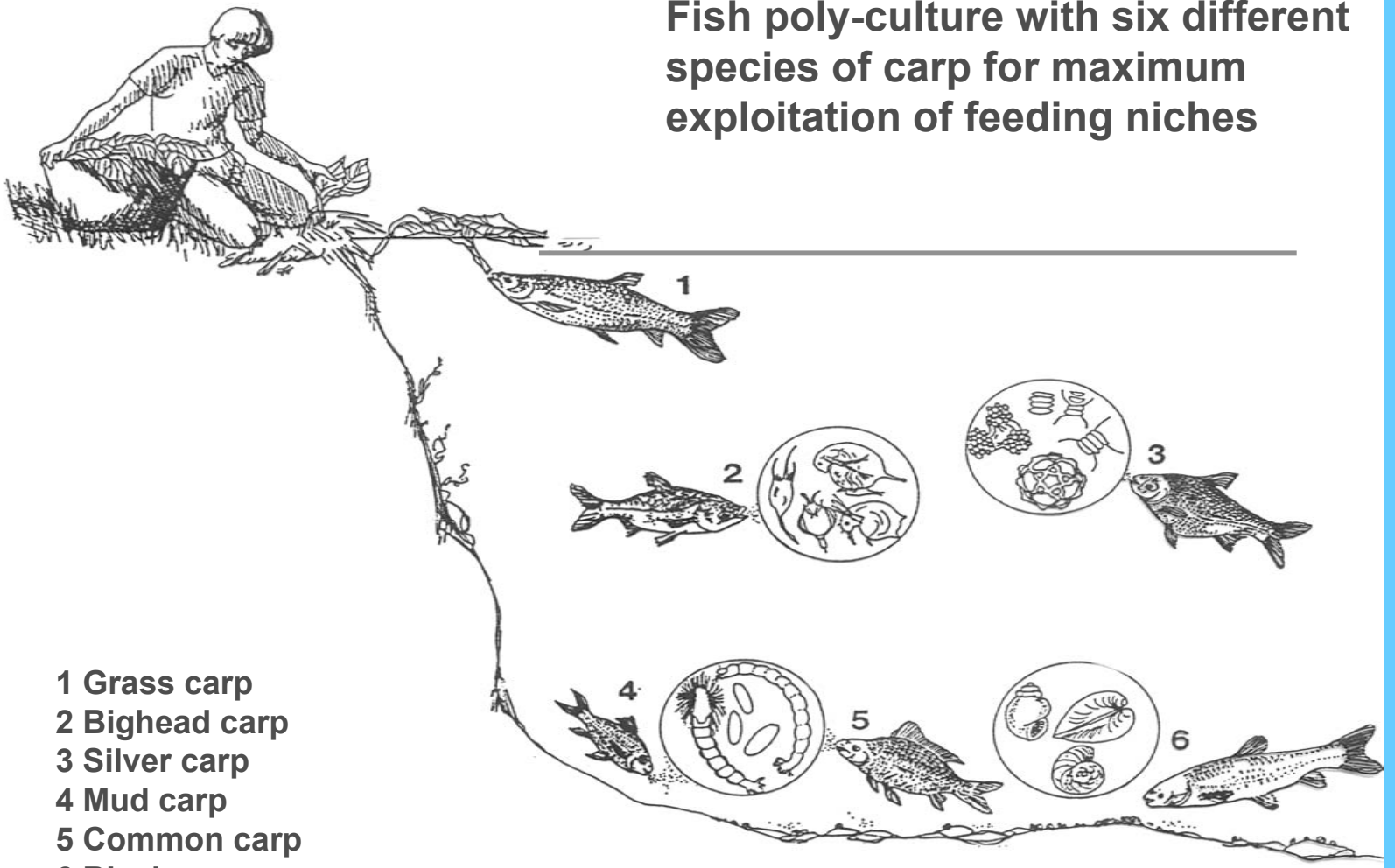


Crop - livestock - fish-farming



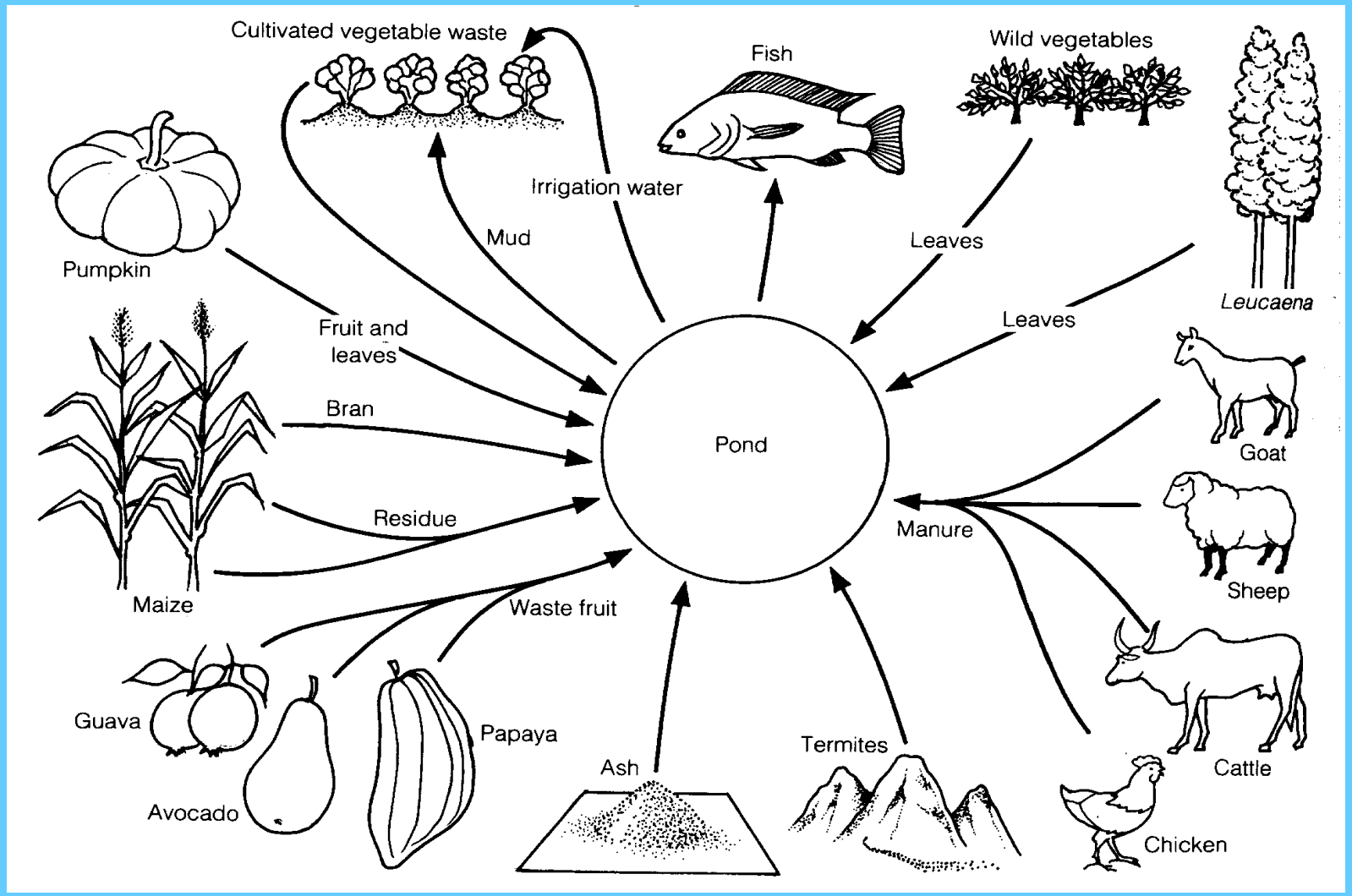
utrient recycling of poultry manure through fish poly-culture

Fish poly-culture with six different species of carp for maximum exploitation of feeding niches

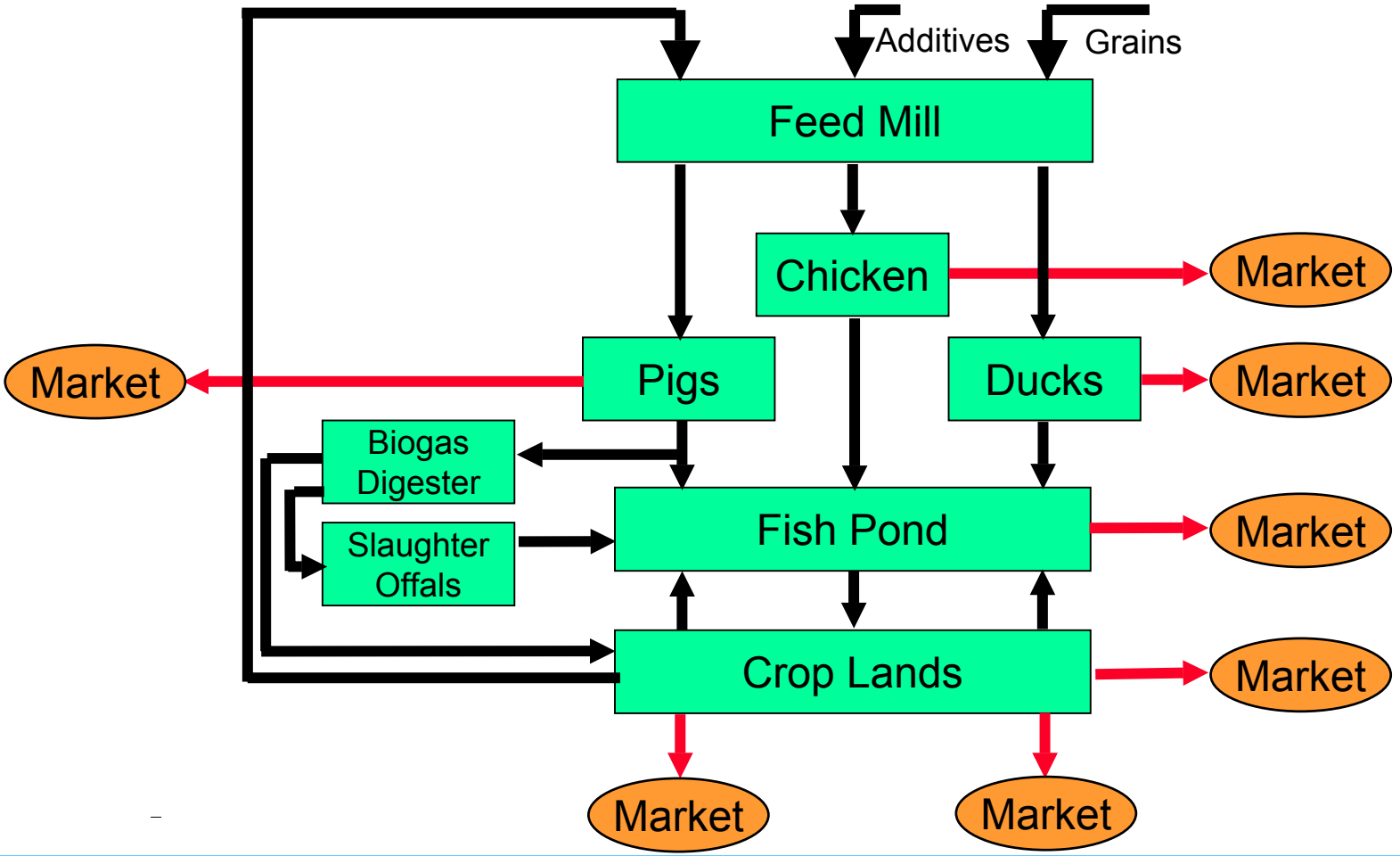


1 Grass carp
2 Bighead carp
3 Silver carp
4 Mud carp
5 Common carp
6 Black carp

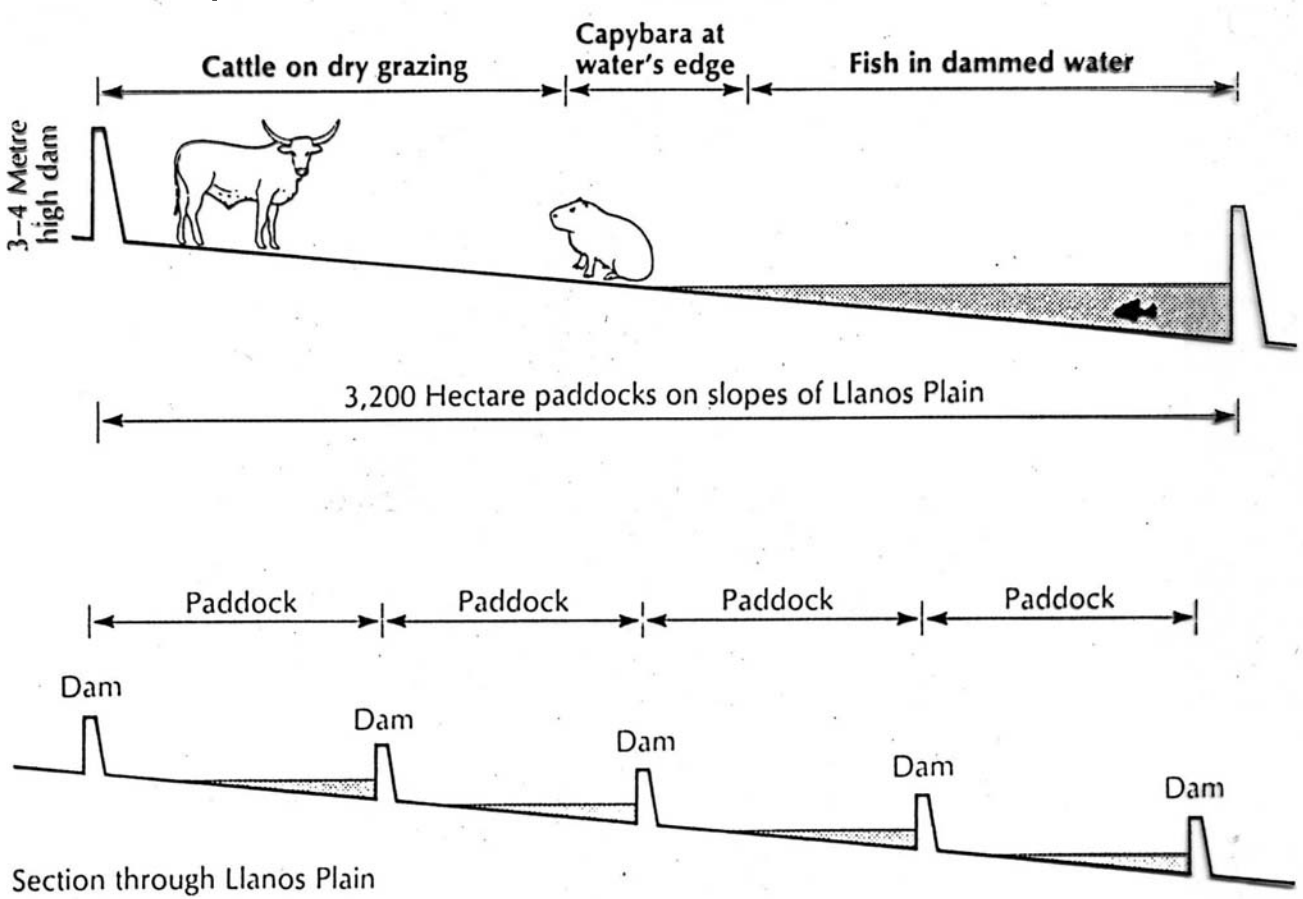
Intensification and diversification of production in large scale farms in China


Cultivated vegetable waste
Fish
Wild vegetables
Irrigation water
Mud
Leaves
Pumpkin
Leucaena
Fruit and leaves
Leaves
Bran
Pond
Goat
Residue
Manure
Sheep
Maize
Waste fruit
Guava
Papaya
Ash
Termites
Cattle
Avocado
Chicken

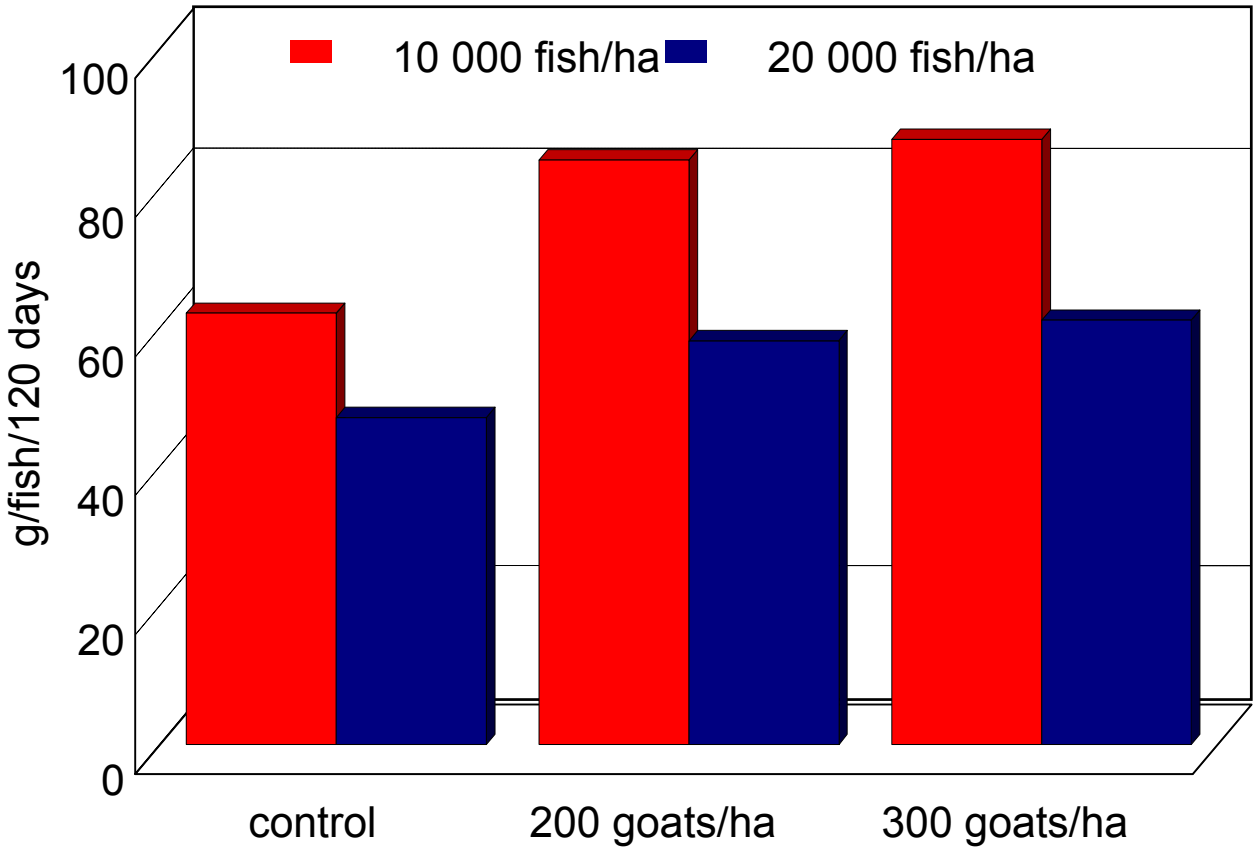
Intensification and diversification of production in large scale farms in China



Grassland system integrating grazing with cattle and capybara, fish production and water catchment functions

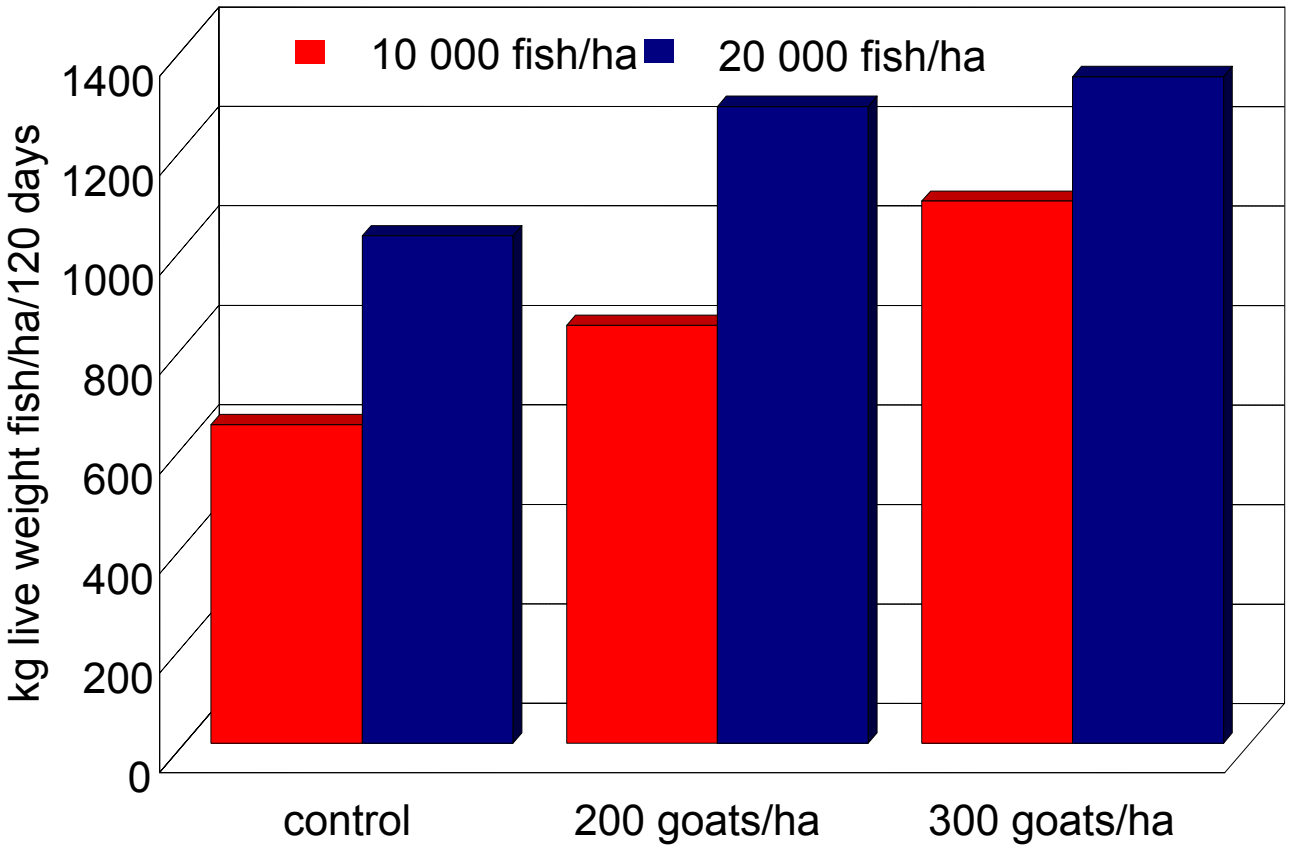


Individual mean weight gain per fish in the second 120-day culture period of *Tilapia* in ponds receiving goat manure



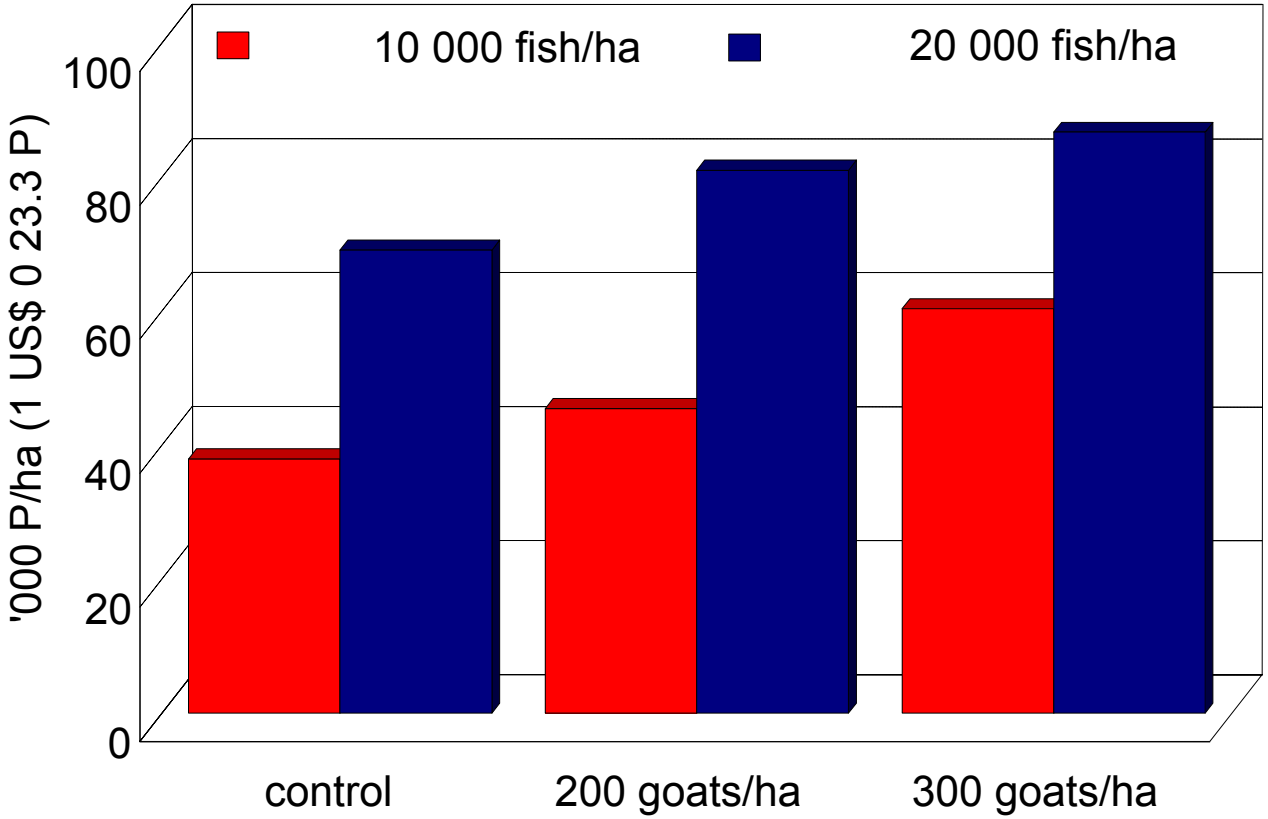
Source: Libunao, 1990

Total net yield of fish in the second120-day culture period of *Tilapia* in ponds receiving goat manure



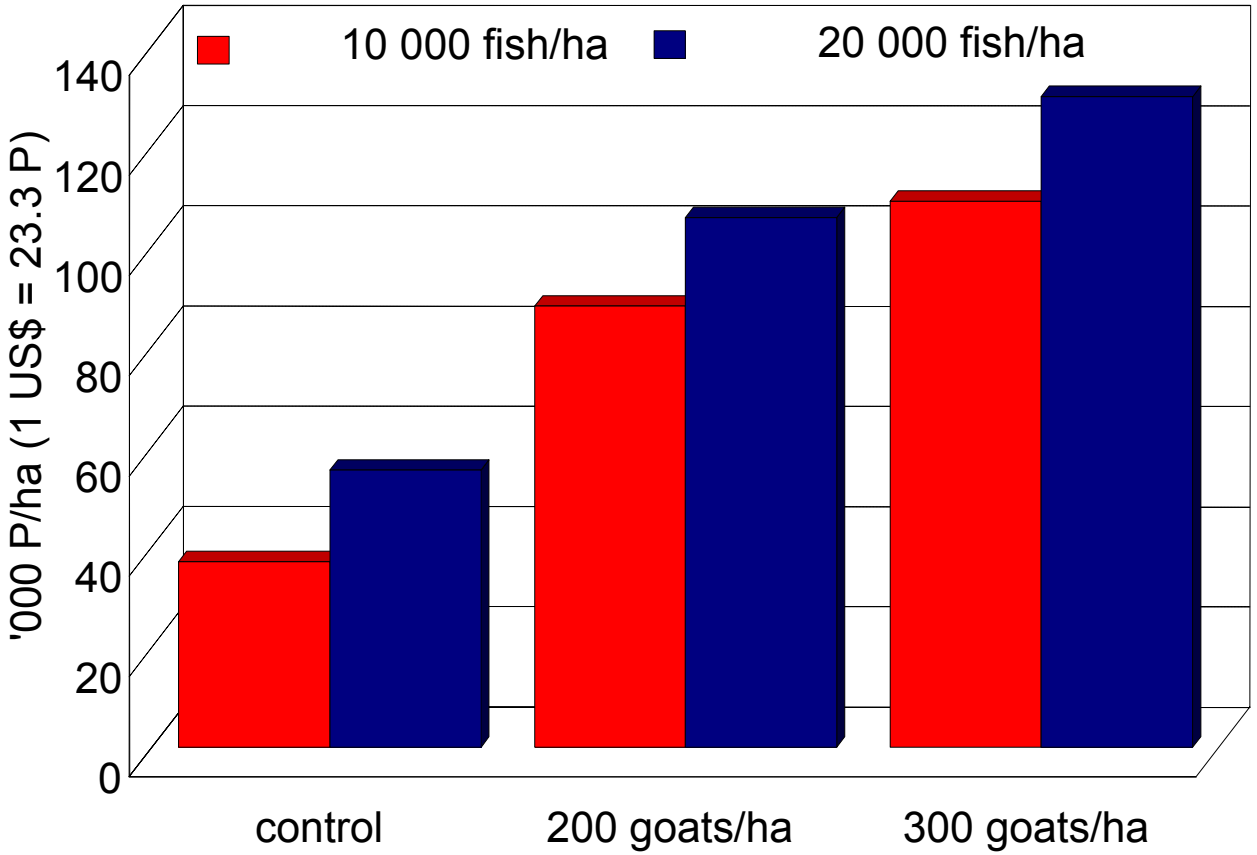
Source: Libunao, 1990

Contribution of fish sales to gross income per hectare pond surface from two 120-day culture periods of *Tilapia* in a 240-day rearing cycle of goats



Source: Libunao, 1990

Net profit per hectare pond surface from two 120-day culture periods of Tilapia in a 240-day rearing cycle of goats



Source: Libunao, 1990

Degree of intensification of duck/fish integrated farming systems

Subsistence → Small scale market oriented → Large scale commercial

Duck

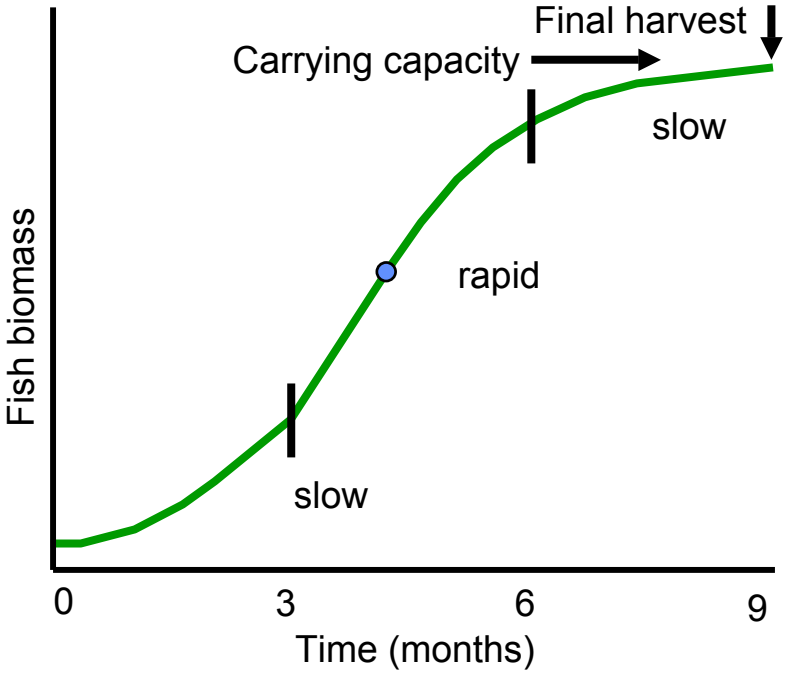
Extensive		Semi-intensive	Intensive
Daylight free range		Total confinement	
Non-cultivated areas	Arable land	Low density and supplementary feed	High density and complete feed

Fish

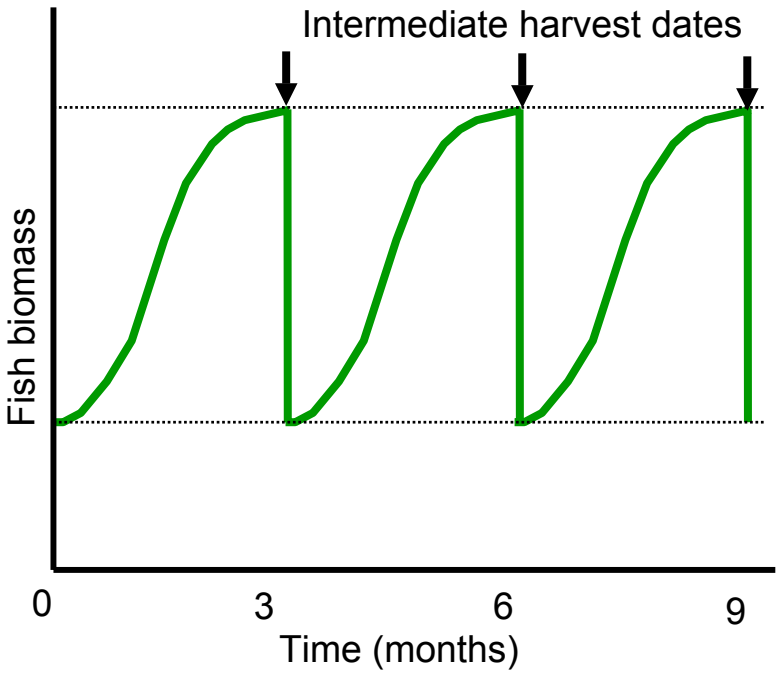
	Semi-intensive	
Manure only	Manure + cereal	Manure + cereal + complete feed

Fish biomass increase in managed pond systems

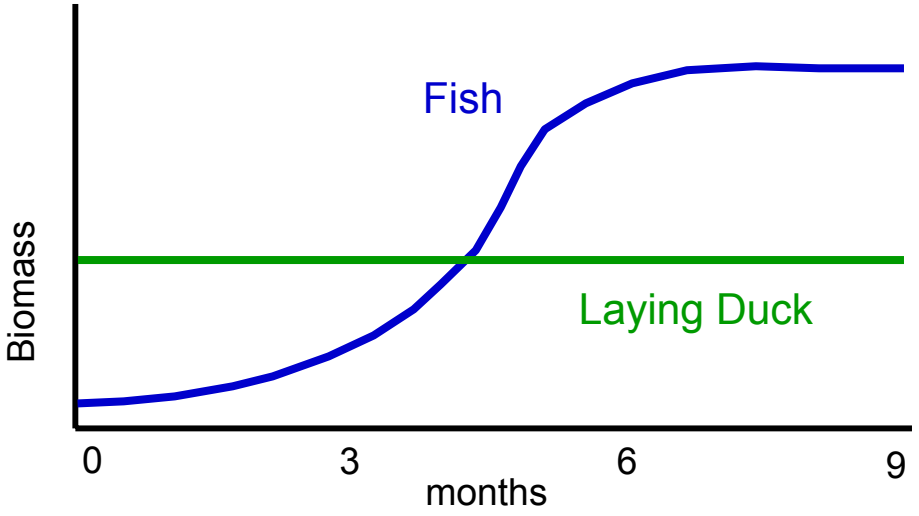
Normal rate of increase
of a fish population biomass

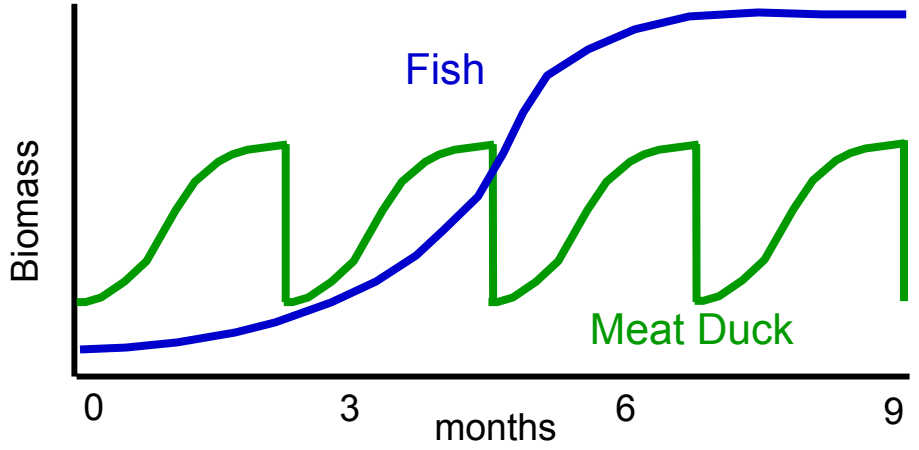


Increase of fish population biomass
at higher initial stocking and
intermediate harvesting



Biomass of egg laying and meat ducks in relation to fish biomass





Source: Farell & Stapleton, Duck Production, University of New England, 1986

Relationship between fish stocking density and fish yield as a function of various pond nutritional inputs

modified after Van der Lingen (1957), cited by Hickling, 1962