Irrigation and irrigation problems in Indonesia

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Geography

- Indonesia is a tropical archipelago country with 17,508 islands (6,000 inhabited). The land area is 1,919,440 sq km and water area is 93,000 sq km which the irrigated land: 45,000 sq km

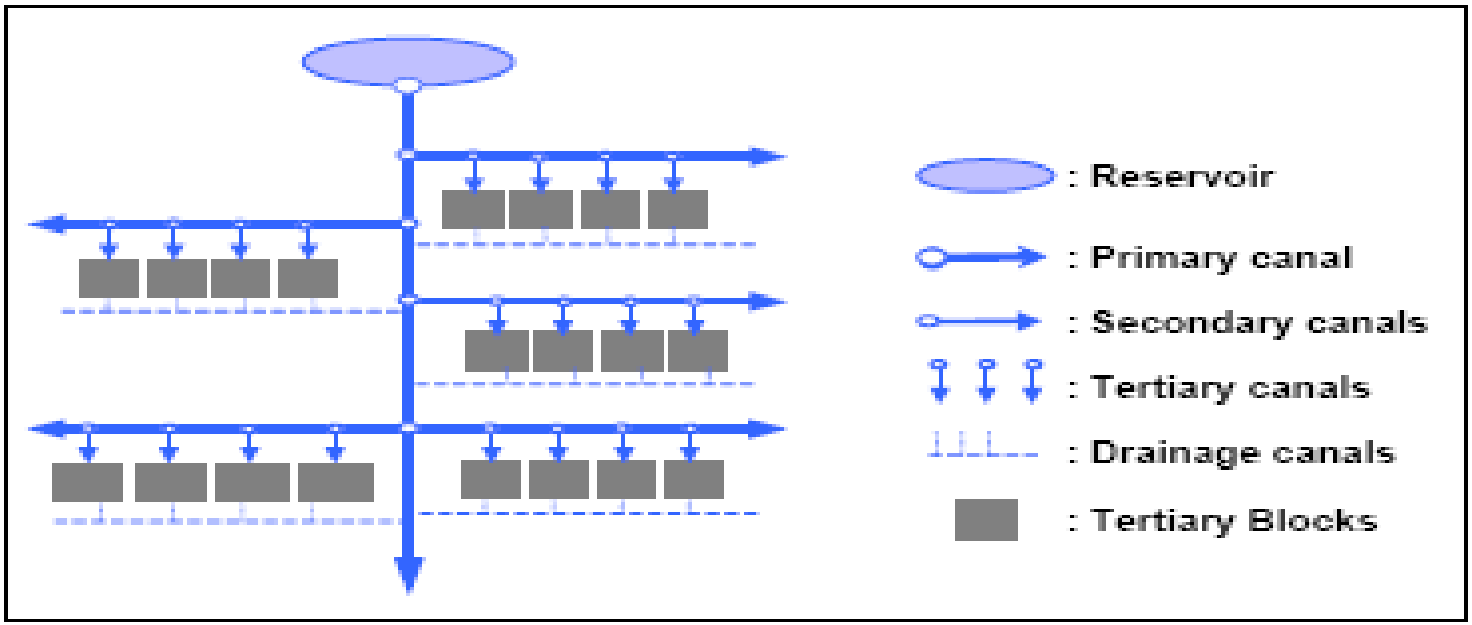
(http://en.wikipedia.org/wiki/Indonesia,2003)

Types of Irrigation in indonesia

- Technical and Semi- Technical Irrigation
- Sederhana Irrigation (a small and simple system)
- Pasang Surut (tide irrigation)
- Other

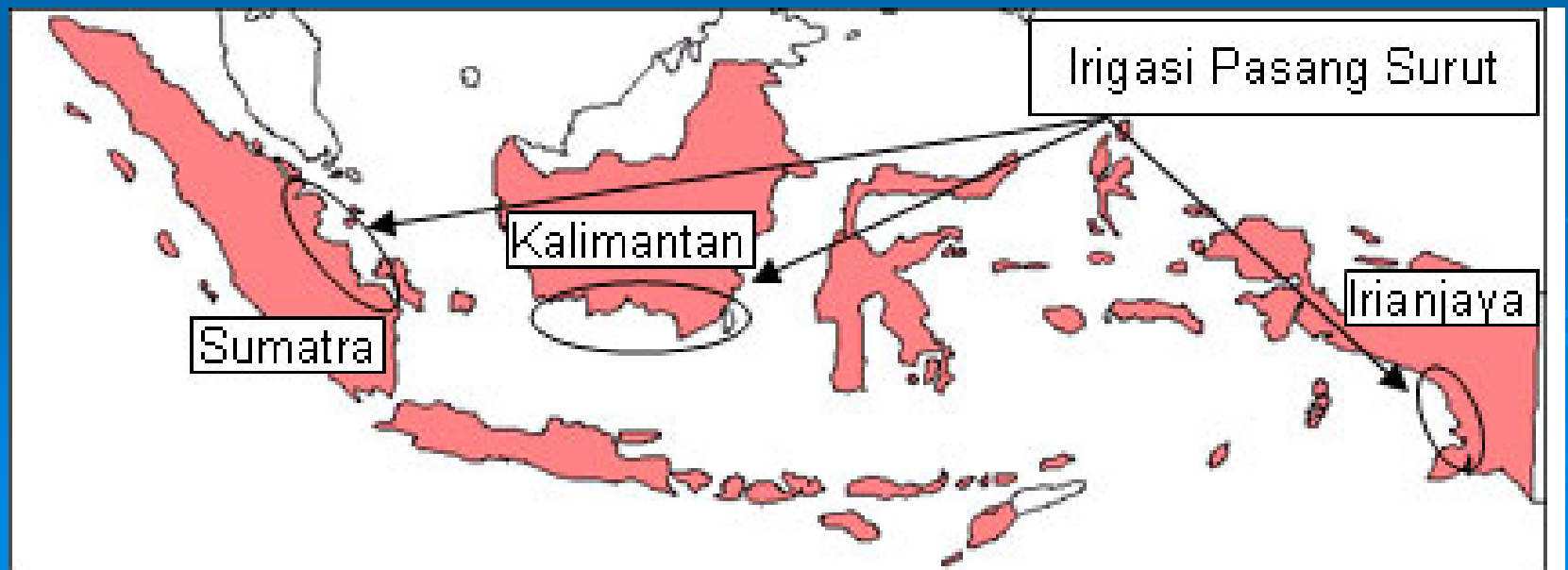
Technical and Semi- Technical Irrigation

- have permanent structures (weirs, diversion boxes, break structures, gates) and the ability to both measure and control water flows.
- Usually consist of main, secondary and tertiary canals, the latte delivering water to a tertiary block (the basic water management unit) Systems usually consist of main, secondary and tertiary canals, the latte delivering water to a tertiary block (the basic water management unit)



Pasang Surut (tide)

This is not really irrigation as there is commonly little or no control over the water flows. It does however require construction of canals and O&M The action of the tide in the coastal swamp areas of Sumatra and Kalimantan causes river levels to rise enabling water in a fully functional system to enter a canal which feeds sawah (Rice field) cleared from the swamp. When the tide goes out the sawah should empty or the water be retained by a gate. In practice only a single low yield crop can be grown in the wet season with limited control.



Sederhana Irrigation (a small and simple system)

Small irrigation systems tend to be at higher altitudes, relief is steeper and fields smaller ; often the primary water source is more reliable being nearer to the major watersheds on the mountains. This type of irrigation is particularly prevalent in West Sumatra, West and Central Java, Sulawesi and Bali

Other:

This is a "catch all" category and refers to swamp irrigation, usually inland, that is not tidally influenced, as well as to groundwater some of which is small scale private development, and some of which is Government sponsored.

Problems in Irrigation

- Water quantity : Limit on the water resources, large losses in conveyance, excess water causes crop losses, water logging and soil salinity, climate change is predicted to increase temperature, reduce rainfall
- Water quality, Surface and groundwater supplies are being increasingly polluted by agricultural, domestic/urban and industrial uses, for example the discharge of Konveksi´s wastewater into the irrigation chanel in Lowa village, comal Pemalang-Java Island.

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Surfacewater are being polluted by domestic/urban

Land, Soil and Drainage

- Lack of Appropriate Land Resources
- Water quality constraints
- Soil conservation technology

Poor irrigation

Many irrigation systems are not delivering the level of water security required for maximum yields. Conditions in rainfed and poorly irrigated sawah (paddy field) are similar - a field that becomes dry due to lack of water in an irrigation canal is indistinguishable from one that is dry because it receives no rainfall

Natural hazards

- occasional floods, severe droughts, tsunamis, earthquakes, volcanoes, forest fires.

- That affected farmer community ;

  loss of farmlands due to sea erosion/scouring, agricultural hand tools and other implements, irrigation channels, sluices and other infrastructure, contamination of domestic water supply dug wells/tube well by salt water,, destruction of dwelling units/hutments/community centers/ drying platforms, contamination of community water supply, damage of coastal mangroves and shelter belts.

irrigation dam in Lampseh village-Aceh-Sumatera.

Which damage causing by tsunami

contamination of rice field by salt water after Tsunami

Methane emission

- The largest present anthropogenic sources of methane are rice fields, cattle and biomass burning. Methane (CH_4) is a greenhouse gas regarded second only to carbon dioxide in its ability to cause global warming

- The methanotrophic bacteria oxidize most of the methane produced in anaerobic environments before it reaches the atmosphere, and in unsaturated soils they oxidize significant amounts of atmospheric methane. Increased rates of methane oxidation and decreases in methane flux may occur as global warming. Therefore, organic carbon would be mineralized and the impact of methane on global warming would be reduced. The use of these bacteria for in situ bioremediation appears to be an attractive possibility.


Thank you very much

Methanotrophic bacteria

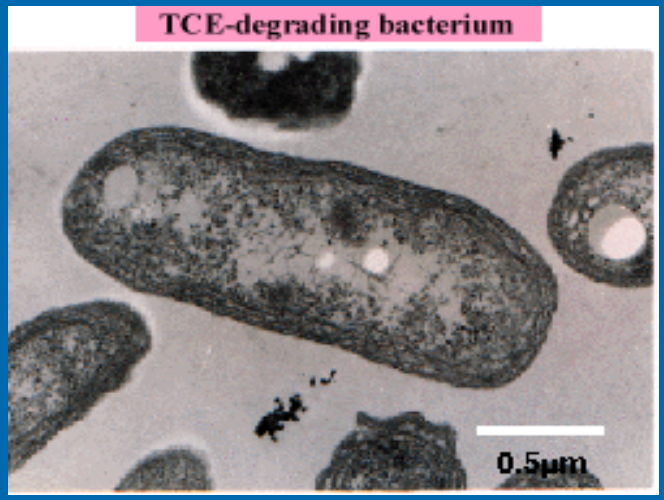
Methanotrophic bacteria, or methanotrophs, are a subset of a physiological group of bacteria known as methylotrophs.

They are unique in their ability to utilize methane as a sole carbon and energy source. Methylotrophic bacteria are those aerobic bacteria that utilize one-carbon compounds more reduced than formic acid as sources of carbon and energy and assimilate formaldehyde as a major source of cellular carbon

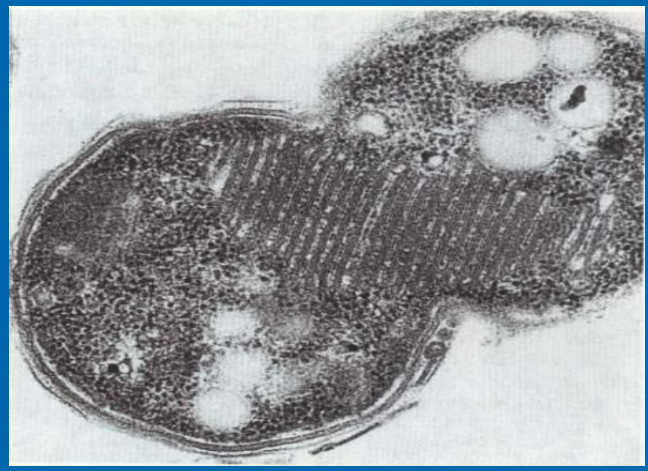
The genera proposed by Whittenbury et al . based on morphological differences, types of resting stages formed, the fine structures of intracytoplasmic membranes, and some physiological characteristics are :

- *Methylomonas*,
- *Methylobacter*,
- *Methylococcus*,
- *Methylocystis*, and
- *Methylosinus*,

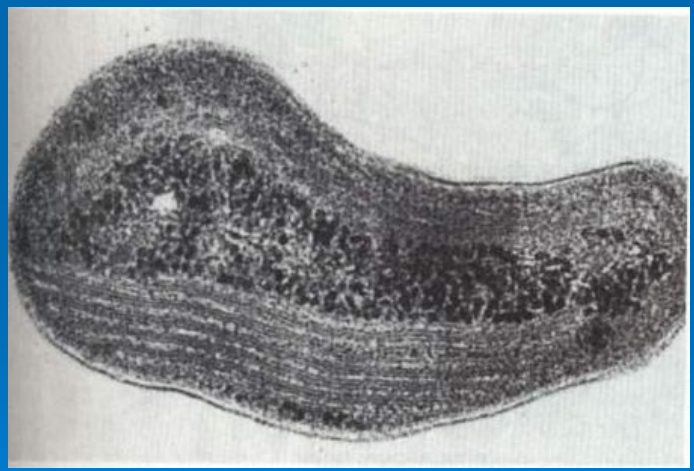
Source :Methanotrophic Bacteria
RICHARD S. HANSON1* AND THOMAS E. HANSON2
Department of Microbiology, University of Minnesota, Minneapolis, Minnesota
http://mmbr.asm.org/cgi/reprint/60/2/439.pdf



Methylocystis

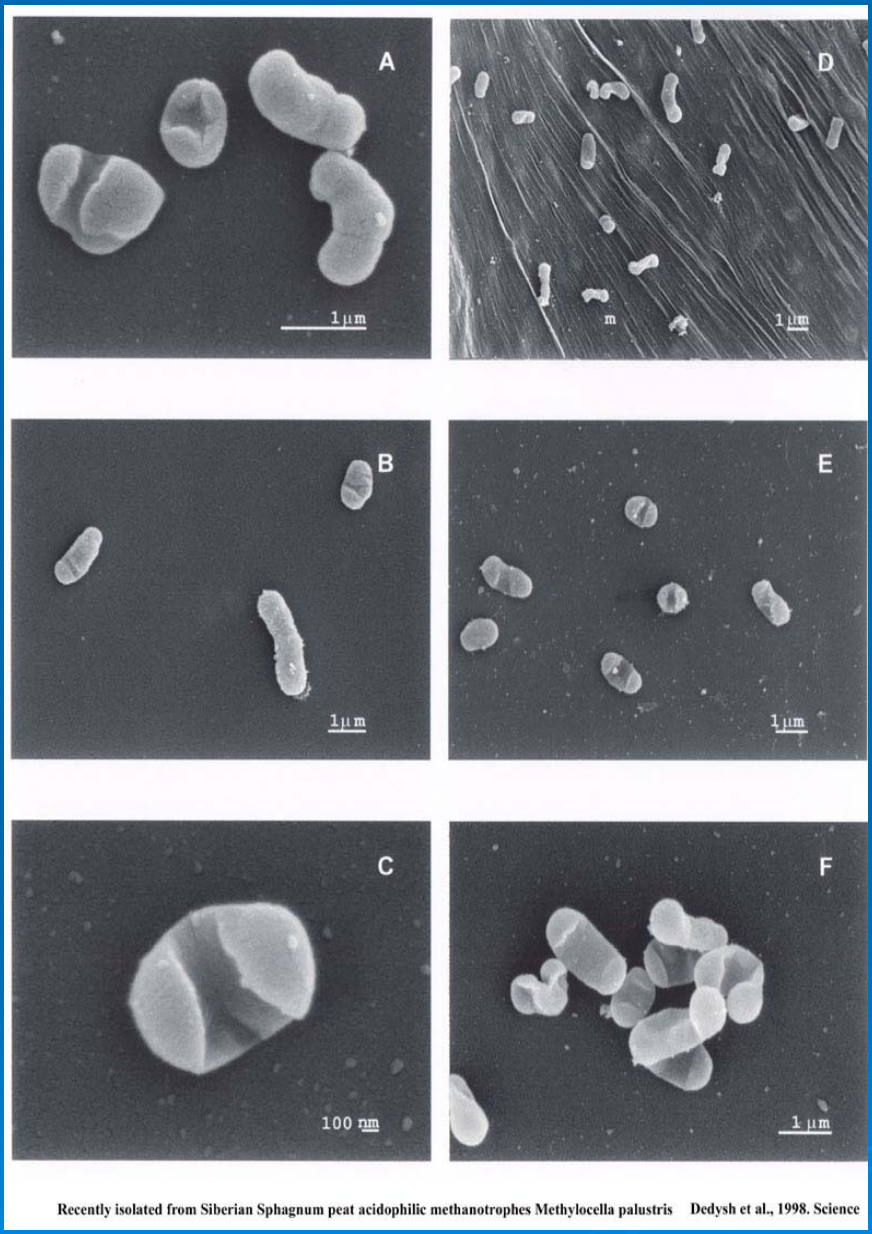


Methylococcus capuslatus,listrating a type 1 membrane system, sells are about 1 um in diameter using electron micrograpphs of methanottrophs.

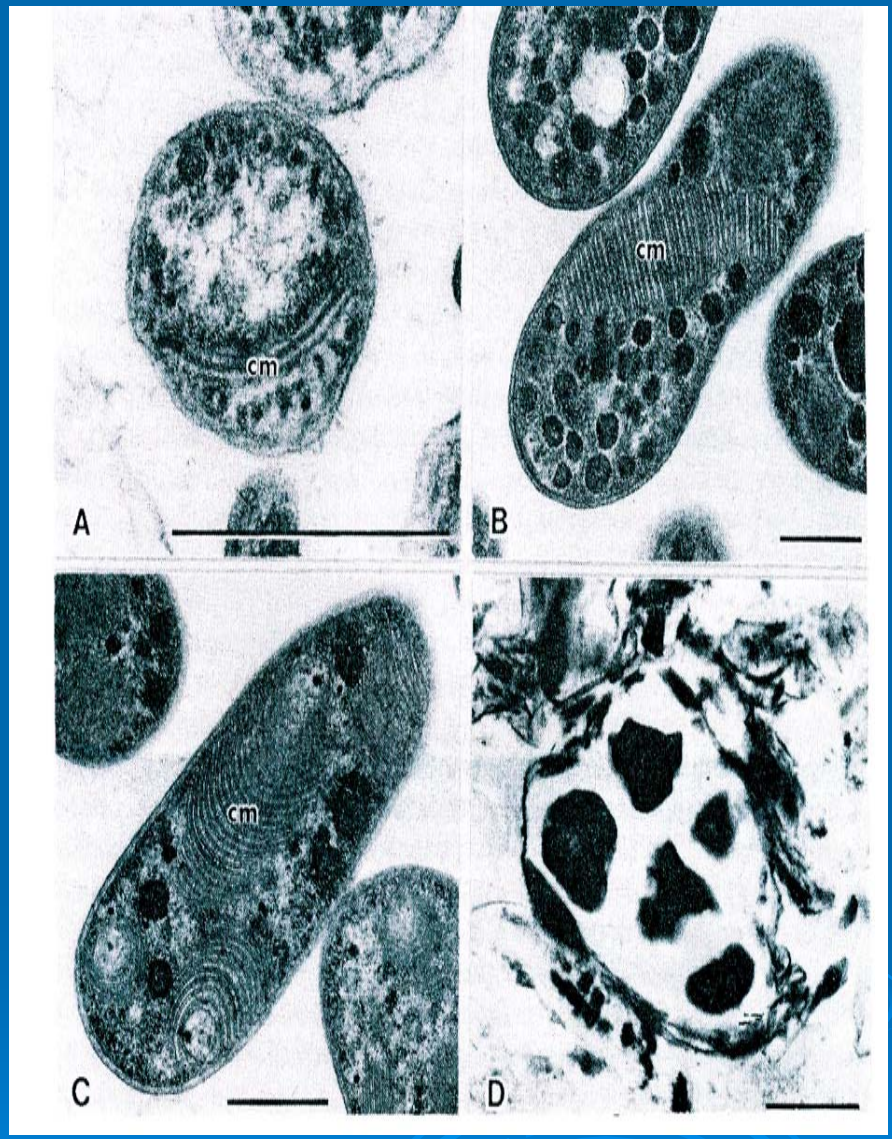


Methylosinus species, illustrating a Type 11 membrane sstem-cells are about o,6 um in diameter.jpg

bacteria-gas-eating-mehlalococus



Methanotrophic bacteria Methanocella



METHYLOMONAS

Location of Sederhana Irrigation

Methanogenis Process

- Methanogenesis is the last stage in the mineralization of organic matter under anaerobic conditions.

- Carbon as a substrate for methanogenic microorganisms is assumed to come from three sources: the decay of organic matter (both freshly added and humus), the death of root tissue from the crop, and carbohydrate exudates from living root tissue.

- the breakdown of organic matter (CH_2O) can result in the production of H_2 and CO or acetate (CH_3COO-). *Methanogenic* bacteria can then produce CH_4 either from the H_2 and CO_2 or from the acetate
  - $CO_2 + 4\ H_2 \rightarrow CH_4 + 2\ H_2O$
  - $CH_3COO^- + H^+ \rightarrow CO_2 + CH_4$

Whichever route is followed, the summary reaction can be written as :

$$2(CH_2O) \rightarrow CO_2 + CH_4$$

A certain proportion of the CH_4 that is produced can be oxidized to CO_2 by *methanotrophic* bacteria if it happens to pass through an O_2-rich environment:

$$CH_4 + 2\ O_2 \rightarrow CO_2 + 2\ H_2O$$


Thank you very much