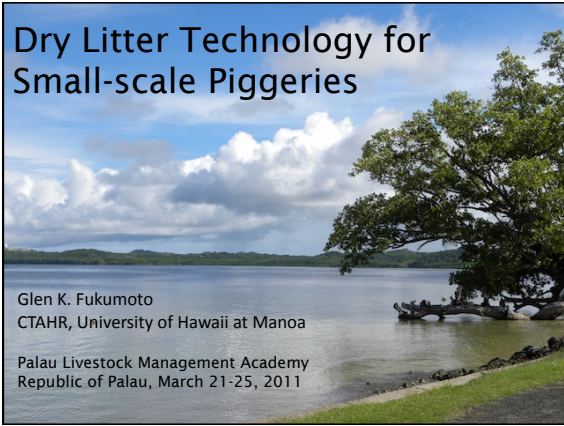


Dry Litter Technology for Small-scale Piggeries

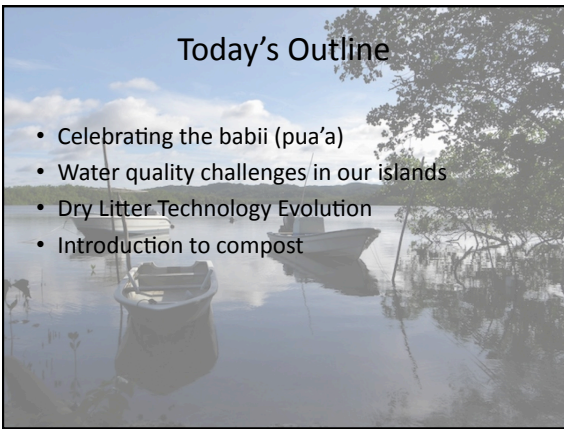


Glen K. Fukumoto
CTAHR, University of Hawaii at Manoa

Palau Livestock Management Academy
Republic of Palau, March 21-25, 2011

Today's Outline

- Celebrating the babii (pua'a)
- Water quality challenges in our islands
- Dry Litter Technology Evolution
- Introduction to compost



In Pacific Island cultures;
the babii (pua'a) is very important!



It's part of our cultural heritage and for celebrations of life!



Birth
First Birthday
Graduation
Marriage
Death

In Pacific Island cultures, water is very important too ...



- In island ecosystems, we are all connected by water
- "wai" is the Hawaiian word for water
- "wai wai" is wealth

Tropical Pacific Priorities

- Drinking Water & Wastewater Infrastructure
 - Safe and Available Drinking Water 24/7
- Non Point Source Pollution
 - Increasing interest in the section
- Coral Reef Ecosystem Protection



Alexis Strauss, Associate Regional Director
U.S.E.P.A., Region IX

Challenges in our Islands

- ECOSYSTEM/GEOLOGY
- POPULATION
- MANAGEMENT of LIVESTOCK

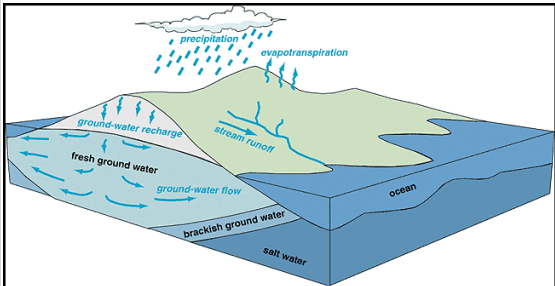


Challenges for Island Ecosystems

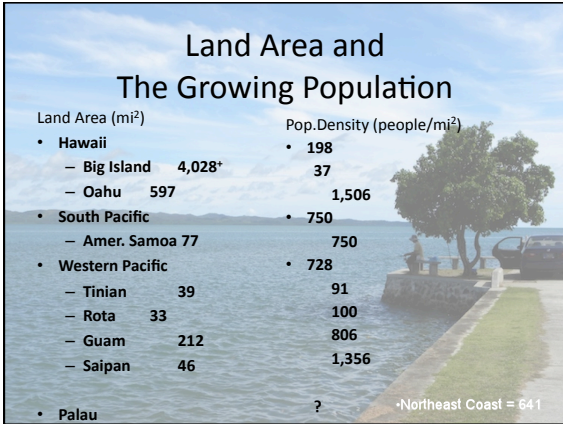


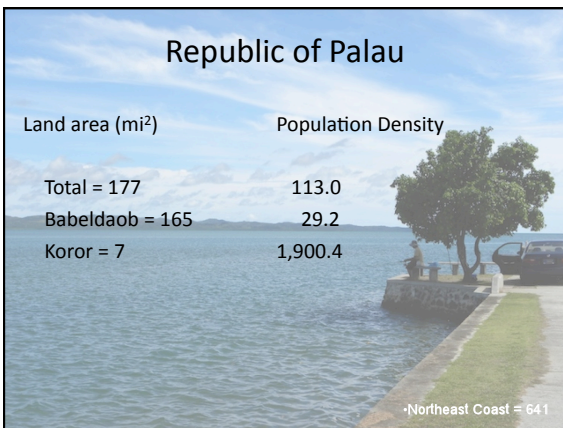
- Surrounded by water
- Limited land area
- Flashy flows from rainfall events
- Short paths to water resources (ground, surface, coastal)
- Agricultural/Urban interface is blurred
- Concentration lead to accumulation in the watershed
- Many fragile tropical ecosystems

Island Hydrology



(Source: USGS)





Current Management Practices Observed in Many Small Piggeries

- Direct discharge
- Uncontrolled flow
- No containment







Palau Water and Coastal Protection Regulations

- Ministry of Health
 - Bureau of Public Health
 - Department of Environmental Health
- Environmental Quality Protection Board
- State Government
 - Eg. Koror State Sanitation

In the U.S., this is the bottomline ... and it's the law!

- No runoff of nutrients into waters of the state
- Contain nutrients; storage structure need buffer for 25yr-24hr storm
- Keep safe setback from water resources
- Keep clean water "clean"

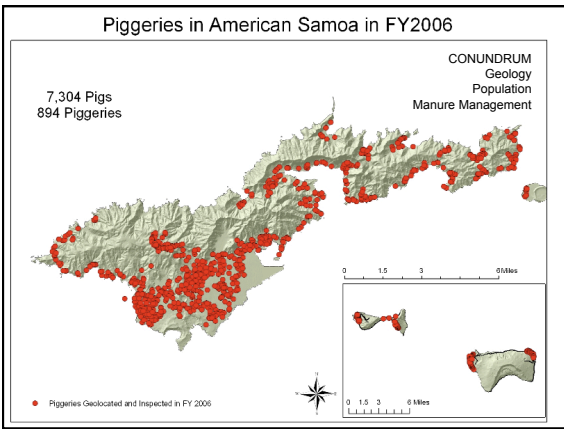
Pathways by which Manure Contaminates Water

Pollutant	Pathway
1) Nitrate-N	Leaching & Runoff
2) Ammonia-N	Runoff & Aerial deposition
3) Phosphorus	Surface water runoff
4) Pathogens	Surface water runoff
5) Organic Matter	Surface water runoff

18

Possible Pollutants	Environmental / Health Risk
1) Nitrate-N	Human Health
2) Ammonia-N	Fish Kills
3) Phosphorus	Eutrophication
4) Pathogens	Human Health
5) Organic Matter	Oxygen Depletion

19



Alternative Manure Management Practices are needed ...

- to avoid environmental degradation of our water resources
- to avoid possible human health problems
– Example – Leptospirosis
- lets take advantage of the nutrients or “fertilizer” value for growing crops to save on imported nutrients.

Paradigm Shift ...

- Today's educational program is focused on RECOVERY and BENEFICIAL USE of nutrients rather than disposal
- Also to incorporate low volume or no water systems.
- Change our perceptions about livestock manure
from a Liability (odors, flies, pollution run-off/seepage)
to a Resource (organic fertilizer, soil amendment)
Resource ... not Liability
Nutrients ... not Waste

Let's focus on Beneficial Use of Nutrients for Crop Production



Birth and Evolution of the Dry Litter Technology

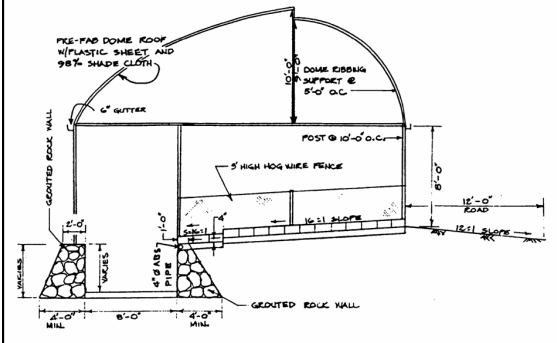
- Livestock Extension 1985
- Hog Farmer George Kahumoku
- Practiced the deep litter waste management system
- Aha moment!
- Proposal EPA 319 grant 1994.

Premise of the proposal
What if ...

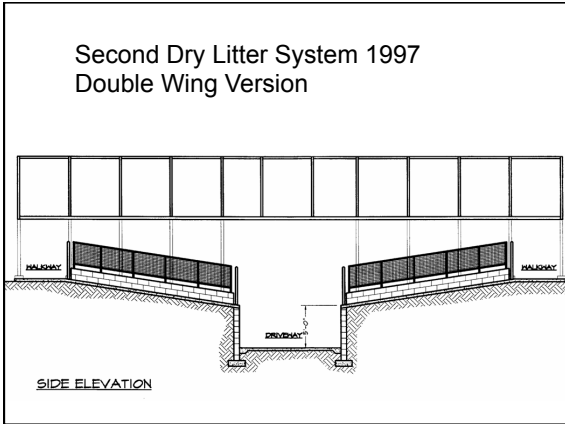
a system that was low tech,
the system was practical,
use no water for pen clean up,
creates no offensive odors,
reduce fly breeding,
creates a new product off the farm,
makes the regulators happy ...



First Dry Litter System 1994









Evaluations

- Pen Slopes
- Various Carbon Materials
- Animal Performance
- Odor monitoring
- Compost product
- Beneficial utilization

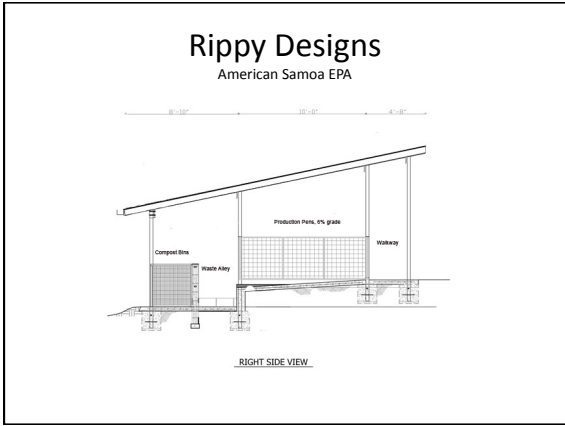
Odor, Hydrogen sulfide

Pen Slopes	40:1	20:1	10:1	Conventional
Production	44-53	28-46	11-18	30 - 54
Storage	6-20	2-11	5-6	66 - 98
Transport				112 - 144

Compost Product

RAW MATERIAL	pH	OC	N	C:N	P	K
MNH	6.2	41	1.2	34	-	-
TT	6.0	48	1.3	31	-	-
COMPOST						
MNH	6.0	38	2.8	13	0.6	2.9
TT	7.0	38	1.6	23	-	-













Advantages

- No water is used in pen washdown
- No discharge of effluent from the pen
- Carbon interaction with nitrogen in the co-composting process reduces odors.
- Low to moderate level of management to operate. The pigs do the work.
- Organic fertilizer by-product for crop use or sold as compost at favorable returns

Disadvantages

- Consistent supply of carbon is required adding effort in acquisition, transportation and storage.
- Cannot be adapted to existing piggeries with flat floors.
- Composting of resultant litter will require additional management

Benefits to the Watershed

Water conservation.
Protection of surface, ground and coastal waters.
Nuisance vectors are minimized.
Odors drastically reduced.
Recycling of greenwastes, other carbon and organic material.

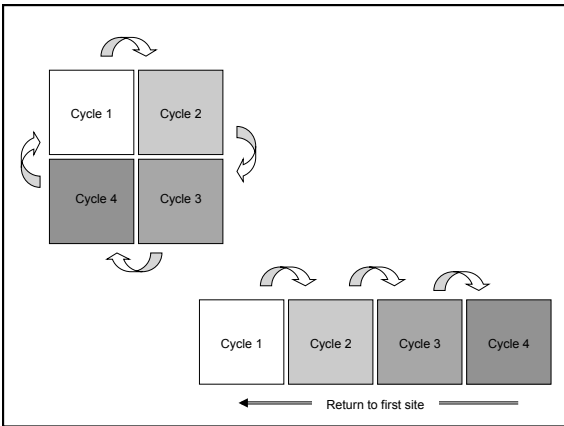
Cost Effectiveness

- No mechanical parts or specialized equipment required.
- The system is designed into the building structure, modular.
- Greater efficiency of land area.
- Adds value to greenwastes and other carbon sources.
- Creates a potential revenue stream from compost or savings from purchase of amendments.

Dry Litter Portable Pen







Advantages

- No water is used in pen washdown
- No discharge of effluent from the pen
- Low level of management to operate
- Low capital and operating cost
- Organic fertilizer by-product
- Requires a small “footprint” or land area

- Keypoint: place wire mesh under the pen to prevent the pigs from digging mud holes.

Disadvantages

- Consistent supply of carbon is required
- Applicable for very small scale operations
- Requires rotation/relocation every 4-5 months
- Cannot be used on steep or rough terrain
- Should not be used over critical water groundwater recharge areas

Composting

A natural process of aerobic, microbial degradation of organic matter

Feedstocks (Carbon & Nitrogen)

Oxygen

Moisture

Time

Advantages

- Composting is an old technology that is used world-wide for manure management.
- Composting is a natural biological process in which microbes convert the manure and plant material into a "humus" or organic soil-like material.
- Composted manure has no odor and is easy to use, so there are many more options for using the compost compared to raw manure
- The composting process will reduce the volume of the incoming material.
 - Experience during 2002 shows that the volume within a composting bin can shrink by 60%-80% in about 3 months

Benefits to the Soil

- Increases soil fertility
- Increases soil aeration
- Increases water-holding capacity
- Enhances plant disease suppression
- Increases organic matter content
- Enhances buffering capacity of soil
- Increase soil erosion resistance
- Increase microbial activity of soil
- Increase microbial competitiveness

"Big Picture" Benefits

- Recycles nutrients (fertilizer)
- Carbon resource utilization
- Saves expensive landfill space
- Compost improve soils
- Increase your plantation productivity

Disadvantages

- Composting is usually just one part of a system (e.g., a solids separator may also be needed at some sites).
- Some effort is required to manage the compost process (e.g., to load and unload the bins).
- It is possible that some pathogens are still in the material even after composting for about 3 months, so it is important to treat the material carefully (avoid direct contact and wash hands thoroughly after using).



Process, 'Pasteurization' temperatures.

Time, Temperature

Aerated static pile:

must maintain a temperature of $\geq 55^{\circ}\text{C}$ (131°F)
for 3 consecutive days.

Active - Windrow:

a minimum of 5 turns required during a period
of 15 consecutive days, with temperature of the
mixture $\geq 55^{\circ}\text{C}$ (131°F).


Characteristics of Good Compost

- Aerobically produced
- Diverse in plant and animal feedstocks
- Stable, no odors, excess nutrients
- Pathogen free
- Weed seed free
- C:N ratio 15-25:1
- Moisture 45%-50%
- Germinate >75% seeds

Composting in American Samoa



Composting in CNMI







Ke Kmal Mesulang
many thanks ...

- for your participation in the workshop.
- to the Workshop Sponsors & Coordinators
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