

## **Why Watersheds? Workshop Itinerary**

### **A One Day Workshop Hosted by CARE International**

#### **Kurunegala – 11 9 00**

- 9.30 Welcome and introductions – Ilange.
- 9.40 Open session – Participant expectations of the workshop.
- 9.45 Session 1: The basics of watersheds and cascade systems in rain-fed areas.  
Inc. Group Session 1: Watershed definitions.
- 10.30 Tea break.
- 10.45 Session 1: Continued.
- Session 2: Implications of interventions at the individual tank level to the wider watershed.
- Session 3: Why integrated watershed management?  
Inc. Group session 2: Resource flows and socio-economic linkages.
- 1.0 Lunch break.
- 2.0 Session 4: Watersheds, Common Property resources and community.  
Session 5: Strength and weaknesses of the integrated approach.
- 3.0 Tea break.
- 3.15 Session 6: The role of inland fisheries in rural livelihoods.  
Session 7: Conflicts and synergies between fisheries and other water uses..
- 4.0 Session 8: Strategies to improve multifunctional use of tanks:  
Peoples Institutions in Watershed Management in India – Video 24 mins.
- 4.30 Participant feed back session.
- 5.00 Close.

Purpose of the workshop: 5 mins

To gain an understanding of the following issues:

1. The concept of watersheds / cascade systems and relevance to rain-fed areas.
2. Implications of interventions at the individual tank level to the wider cascade.
3. The concept of integrated watershed management in the Dry Zone: what does it mean? how should it be approached?
4. Watersheds, CPRs and the importance of community involvement
5. Strengths / weaknesses of the integrated approach
6. The role of inland fisheries in rural livelihoods (income, protein, cohesion)
7. Potential (or actual) conflicts / synergies between fisheries and other functions of a tank (irrigation, bathing....) and way to avoid/enhance them.
8. Strategies to improve multi-functional use of tanks / cascade

Why watersheds – a question of scale:

**Fig 1: Livelihood systems and the agro-ecosystems hierarchy (Edwards 1989).**

CARE household and village / Individual tank focus.

Neglected areas in development: Scale (watersheds), common property resources (conflicts) and Caste (defining limits of community participation).

**Fig 2: Map showing location of research areas (Murray and Little 2002)**

Division into activity groups (Max of 4 groups).

## **1. Session 1: The concept of watersheds/cascade systems & relevance to rainfed areas**

### **Group Activity 1. 20 mins. Definitions:**

1. Rain fed tanks/areas,
2. Assured irrigation areas/system tanks.
3. Seasonal & Perennial
4. Watershed
5. Cascade system,
6. Integrated watershed management
7. Community (in the dry-zone).
8. Common property/pool resources

Define 1 & 2 – Other definitions to follow.

*Traditional watershed management in Sri Lanka – The cascade system*

**Definition:** A series of hydraulically connected small tanks draining to a common reference point, thereby defining a sub (meso) -watershed with a definite boundary. Typically fed and linked by ephemeral streams draining the micro-watersheds around individual tanks.

2-25 tanks per cascade, normally terminating in a perennial, stream, river or irrigation system.

## Distribution and size of cascade systems

Fig 3: Map showing distribution pattern of minor tanks in Sri Lanka (Agrarian Services Department GOSL 2002).

Fig 4: Map showing distribution density of minor tanks in Sri Lanka (Panabokke *et al* 2002)

Greatest no tanks in Kurunegala and Anuradhapura districts (centre of ancient irrigation area). Next Moneragale and Hambantota.

Distribution / seasonality factors:

Rainfall distribution – density increases with RF

Underlying geology – Soil permeability >est in upperwatershed areas

Geomorphology – Density greatest in gently undulating areas such (2-4% slope – greater retentiveness of the water table) lower 8% slope.

Kurunegala with it's gently undulating topography (smaller steeper watersheds) has greatest numbers of smallest tanks with the greatest number of dependents.

Anuradhapura (flatter plain) has slightly fewer/larger tanks but greater waterspread and generally larger cascades with greater numbers of tanks.

A cluster of cascade systems forms the sub-basin of the river and all the sub-basins the watershed of the river (i.e the Mi and Kala Oya Basins in NWP)

Totals: 18,378 tanks (restored and abandoned – see later) serially numbered on 1" maps, constituting 3,500 to 4000 cascades (33% not marked in current research areas). Est ~9k functional tanks currently supporting village communities and irrigating ~150k ha.

Table 1: District-wise distribution of tanks by surface area

Fig 5: Watersheds and cascade systems of Anuradhapura District (Sakthivadivel *et al* 1996)

Table 2: Classification of cascade systems by spatial and social criteria

Classification: Topographical (useful for site selection):

Form: Linear or branched:

Form more linear systems:

Small: < 1,000 ha	up to 3-4 axial tanks	300-400 households*
Medium: 1,000-2,000 ha	4-8 axial tanks	400-1,000 households*
Large: 2,000-3,00ha	8-12 axial tanks	>1,000 households
V Large >3,000ha		

\*Note based on systems in field areas in N Kurunegala and Puttalam Districts

DAS: Tank classification by CA – Med = 80-600ha

Fig 6: Schematic of a simple linear cascade (Panabokke *et al* 1996)

Fig 7. Pictorial view of a simple linear cascade system (Sakthivadivel *et al* 1996)

Fig 8: Schematic representation of linear and branched cascade systems (Sakthivadivel *et al* 1996)

## 2. Implications of interventions at the individual tank level to the wider cascade.

Classification: hydrological (useful for site selection and tank rehabilitation planning).

Principal functions:

- ✍️ Equity in water distribution at different levels of the watershed in years of lowest rain for multiple village uses – even during years of below average rainfall.
- ✍️ Regulating volumes of flow to prevent bund breaching and soil erosion.

Good evidence of historic perception for need of watershed at individual tank level - watersheds divided into different sections for different purposes: paddy, chenna, forest above tank undisturbed, buffalo wallow, houses and HG's adjacent to tank benefiting from increased water table.

but little by users or planners at the watershed level.

Altering the hydrology of one or a few tanks could alter the hydrology of the whole cascade.

*Explain traditional land use patterns around the tanks*

Fig 9: General layout of a village tank (Ulluwishewa 1991).

Shifting water deficits – continuing problem – requiring a basic understanding of hydrology at tank level.

*Explain basic hydrology:* Radial/ Axial tanks, linear or branched hydrological endowment of individual tanks and the whole cascade, trends in seasonality linked cropping patterns inc. supplementary irrigation, seasonal variation linked to climatic trends.

With respect to Form: Hydrological better endowed cascades tend to have a linear or slightly branched form, large area to length ratio (>1.5) and a gently sloping gradient on their main axis.

Density: Critical are:

Rainfall (decreasing Northwards and Eastwards).

Geology/Lithology (W. A'pura low density assoc with high permeability – Central area has greatest density).

Highest density in gently undulating terrain 2-4% slope range

Seasonality definition – Intra watershed variation highest in upper water shed and radial tanks (steeper, often porous soils, radial tanks with small micro catchments). Highly Seasonal – dries every year. Seasonal – at least 1x/5yrs, Semi –seasonal < 1x/5yrs. Perennial - never dries in recent memory,

Upper tanks – Supplementary irrigation – often more co-ordinated management as transfer losses much more critical with respect to whole range of water uses.  
Climatic change (and other structural changes) – abandonment of paddy cultivation under seasonal tank – high risk and increasingly assured off-farm options.

Assessment:

Ratios of catchment, water storage capacity and command area.

Simple assessment: Spill frequency, Cropping Intensity – Deficit/Surplus cascades.

### **Why watersheds?.**

Only since the mid 80's have researchers seen a need – no significant adoption.

Existing rain-fed area development focus around individual tanks.

Tank definitions: Working, abandoned, rehabilitated

See Page 9 WP 3 for working definitions.

Focus on tanks supporting more than 25 persons

Restoration of 1. abandoned tank, 2. non-working tank, 3. improvements to working tank 4. Refurbishment of working tank (usually maintenance of bund and spill way.

De-silting is the most expensive option.

Government approaches: First top down blue print approaches focusing only on paddy component – physical improvements to increase water availability  
Next more iterative rolling planning approaches incorporation of needs of chenna farmers. Many continued to suffer from inefficient planning, design and implementation.

NGO approaches: Focused more on farmer mobilisation and participation in all stages of development – approach gradually adopted by govt schemes. NGO schemes have been more likely to fall down on systematic monitoring and evaluation.

System selection: farmer mobilisation and leadership, integrated project planning – good project management and co-ordination.

However today few projects still see the need to operate at the watershed level and those that are have yet demonstrate meaningful integration of activities at this scale.

Tea break

### **Group activity 2. Why watersheds - Watershed linkages?**

Agro eco-systems: Resource flows upstream and downstream linkages

Socio-economic: Social and institutional linkages.

### **Watersheds, CPRs and the importance of community involvement**

Fig 10: Map of Pahala Diulwewa cascade system, Puttalam District, NWP (Murray and Little 2000).

What is a community? Access to a common resource base – common pool resources.  
Socio - economic boundaries (kinship, caste, institutions)  
Physical factors (i.e. watershed boundaries).  
Local membership v. transhumance strategies (recipricocity) i.e. fishing communities.

2 Principle forms rural community in the dry-zone:

Irrigation Colonies: : Infrastructure – structural change accompanying large-scale irrigation.

Purana complexes: Traditional settlements established around larger perennial or semi-seasonal tanks. Communities bound together by caste and kinship with limited inter-marriage outside the PC (kinship groupings within caste groups – surnames). PCs normally have access to 1-2 perennial or semi-seasonal axial tanks and 1-13 HS or S radial tanks.

Traditional rotated by farmers under larger tanks – but increasingly settled – often with ownership residing under the main tank for irrigation purposes – share-cropping.

Only in Expanded PC Service centres – located at strategic junctions at the foot of 1 or more cascades – well endowed with water significant mixing.

PC Definition: A fundamental unit which combines discrete social assemblages sharing a well-defined access, both private and common, to a range of natural resources.

Despite weakening of formal caste system (Arachi) – divisions remain as keen as ever Feudally based system – over 50% of the population belonging to the dominant cultivator caste. Lower groups often marginalised with respect to:

- Education

- Access to productive natural resources
- Relatively high dependency on seasonal casual OF labour
- Exploitation of the natural resource base – often unsustainable – conflicts.

Where occasionally mixed villages occur (due to contemporary recent colonisation) lower castes are often excluded to the periphery of the village / seasonal tanks.

Patterns of colonisation and re-colonisation – mean that kinship/ caste linkages often extend more horizontally than vertically in an STC.

Often only linkages between neighbouring PCs are DDSs and External Govt officers (Samurdhi, GN, GSN) often cover 3-4 adjacent villages (within or across watershed boundaries).

FOs main have principle responsibility for the management of tank resources - but Many FOs recently established for eligibility for Govt benefits – low activity levels and poorly representative of the land poor and landless (increasingly youth – intergenerational conflict).

**Table 3: CPRs & associated livelihood activities in rain-fed areas of North Western Province**

Relative importance of CPRs depends on both on location in watershed (access relationships defined by PC demarcations) in addition to strategic location in the dry-zone.

### **Strengths / weaknesses of the integrated approach**

Pro's:

Fuller understanding of livelihood systems and hence ability to forecasting of impacts of interventions on different users and uses of resources.

i.e. bathing v. consumptive use of water for irrigation and quality reducing use of water for fishing.

Choice of suitable scale: For interventions to have the most cost effective and sustainable impact on target groups i.e. watershed approach.

Mitigation of potentially unforeseen negative impacts conflicts – some times better to do nothing!

i.e. Downstream movement of water deficits/ fish recruitment impacts through – single tank approaches to rehabilitation

Sustainability: Understanding of interrelated ecological, economic and social aspects of livelihood systems enhances the possibility of achieving sustainable development

Con's

Complexity of holistic approach: Increased difficulty in understanding interrelated aspects of livelihood systems – requirement for greater time investment in situation analyses, learning or hiring interdisciplinary skills, team work, field presence.

Logistical. Potentially increased time and expense in planning, difficulties when requisite scales of activity are greater than household or village level (though there may improvements in implementation and monitoring phases due to focus in a few watersheds as opposed to scattered villages.

Willingness to really adopt a holistic / integrated approach. Often we just adopt the jargon of new development paradigms and behave in a traditional 'sectoral' manner related to our core specialities.

Unwillingness of neighbouring communities to participate in collective management due to deep seated cultural (caste/ethnic) differences and potential to enhance conflicts.

Lack of suitable vertical and horizontal integration between different government line agencies.

**Fig 11: The livelihoods framework (Carney 1998)**

### **The role of inland fisheries in rural livelihoods**

*Protein Consumption*

Key points: Fish over 70% of animal protein consumption in SL.

Marine fish: Urban areas almost exclusively fresh marine fish.

Inland fish: Rural areas: almost exclusively fresh inland fish (except arterial routes and service centres).

Dried fish: In both areas meal frequency greatest for imported dried marine fish - as excess demand for local fresh fish and storable in absence of refrigeration – no profit in processing – only for salvage.

Inland fishery 90-95% exotic tilapia production introduced in the 1950's – extremely well adapted to abundant and shallow irrigation systems.

Cheap, exceedingly fresh (excellent handling characteristics), relatively flat production compared to the marine fishery. Highest production during the dry-season when agricultural income is lowest.

'Fish is so cheap it is substituted for vegetables'!!!

**Fig 12: Seasonal agricultural livelihood calendar North West Province, Sri Lanka (Murray and Little 2000).**

*Potential for income generation*

2 sectors: Commercial perennial fishery – subsistence seasonal fishery.

90% of all recorded commercial production comes from 74 of largest perennial systems in the dry zone. Unmechanised canoes gill nets. Tanks < 200ha rarely possess a full-time fishing population.

Small Seasonal Tanks? –

Commercial: Very little commercial production so negligible record of yields.

- Off-flavours and colours associated with turbid and soapy seasonal environments (snakehead only exception – but disease problem).
- Highly seasonal production – small peak between Maha and yala with bulk during July – August dry season due to bans on fishing for priority irrigation and bathing functions.
- Lack of gears in villages due to small-seasonal window – must wait for

Production: Seasonal tanks potentially more productive than perennial systems – drying out/mineralisation, draw-down grazing.

But constrained by seasonal water availability and cyclical impediments to restocking during drought years.

Trend to reduced spill frequency by climatic change and more intense rehabilitation activity accompanying demographic change.

Livelihoods:

Increasingly important (inc perennial water resource and exotic tilapias) but difficult to get accurate data on participation from casual survey – because:

Cultural taboos on fishing activity (low caste activity)

Secondary nature of the activity to many livelihoods.

Off-farm labour

Direct observation.

Fig 13: Principle marketing chains for inland fish in Northwest Province Sri Lanka (Murray and Little 2000)

Commercial fisheries provide extremely important for a large number of full-time and part-time actors both production and vending.

Important means of diversifying livelihood activities of the land poor particularly during the dry-season when other opportunities are few.

Contrast to agricultural livelihoods. Low overheads for entry (inputs bicycle and a box), market space and seasonal production patterns – widely distributed production sites, rural consumers and small daily production – prevents domination by middlemen. Increasingly important to emerging breed of fishermen / small-holder farmers.

Seasonal tanks:

Subsistence function – often for disenfranchised youth (includes recreational component) or poor villagers from lower caste communities for household consumption.

Insert PWD fishing mobility map.

Constraints and opportunities for development.

Commercial fisheries:

Development?: ‘Redistribution before growth’ or ‘growth at any cost (modernisation)’ - Local people focussed priority.

Main requirement: Sustainable management of existing stocks – tilapia extremely durable – but secondary impact of increasing fishing on biodiversity.

Stocking not cost effective in large reservoirs – CPU

No demand for inland fish exists in urban areas – hence no demand for product diversification or post harvest processing. Growth at any cost policy??

Seasonal tanks.

Lack of commercial demand for production of smaller semi-seasonal tanks.

Highly seasonal window because of other water use priorities and increasing conflict in smaller tanks.

Stocking feasible (high demand and niche market for exotic carps) but:

No potential for private sector seed market - opportunity cost for ornamentals

Highly limited state production potential.

Community based seed production may possibly be viable only in intermediate size tanks 200-800ha. But constrained by likelihood of free-riding and risks exclusion of existing subsistence users.

Lack of suitable horizontal and vertical institutional support to re-enforce such strategies and access to open access fisheries.

Fig 14: Map showing major irrigation systems supporting perennial commercial fisheries in the research area (Murray and Little 2000).

**Potential (or actual) conflicts / synergies between fisheries and other functions of a tank (irrigation, bathing....) and way to avoid/enhance them.**

Individual tank level

Must also consider different users / uses of water – some of which are mutually compatible and incompatible and seasonal variation in priority of different uses by different user groups:

Compatible

- non –consumptive uses (fishing) with consumptive use for irrigation

Non compatible

Water quality modifiers whilst both bathing and fishing are non consumptive they both have –ve impacts on each other with respect to water quality.

Seasonal variation in priorities must be understood.

Cascade level

Tank rehabs which reduce spill frequency and volume reduce natural recruitment.

Poorly perceived

More readily perceived are access conflicts.

PWD example –

**Fig 15: Fishing mobility chart Pahala Diulwewa Cascade, Puttalam District NWP (Murray and Little 2000)**

Traditional collective activities – source of village cohesion

Collective fishing – Traditionally low input/out, rotational, highly equitable, cohesive & sustainable.

Shrimadana – Traditionally socio-religious.

Tank clearance (Salvenia), Bund, road, school, temple maintenance/ clearance.

Increasingly part of dependency system: Samurdhi eligibility.

Bethma – Yala cultivation.

Catchment preservation – Adherence to ban on forest cultivation immediately above the tank.

Collective fishing – Formal management no longer common – formally regulated under the vel vidane – equitable distribution and sustainable management – include designation of fish refuges.

Triggered by events which reduce quality of water for primary dry season use for bathing:

Poaching, livestock (particularly WB) ingress, extreme low water levels (risk of fish kills reducing water levels).

Nor formal notification – often just a sudden peak in intensity.

Water quality adversely affected for 1-2 weeks. Travel to other local perennial resources dependent on transport facilities access to private water resources (often poorest rely on remaining storage).

## **Strategies to improve multi-functional use of tanks / cascade**

Understand priorities for usage

Transhumance strategies

Recipricocity between resource management and exploitation within and between villages: i.e. Salvenia clearance/ bund maintenance and fishing reward

Could also help to remove existing welfare dependency

Fisheries:

Hi input – output systems (community based fingerling production/stocking) which increase potential return and risk of losses – attract increasing participation when and conflict when inputs are provided free and potential exclusion and conflicts when individual groups become involved.

<10% to > 70% of HH participate in at least irregular or CF activity.

When existing participation is high enhancement of existing systems encouraging small but widespread benefit to the largest no of participants can help to improve cohesion.

Enhancement strategies:

Seed

Move small amounts of locally available broodstock to tanks with recent history of CF followed by drying and no subsequent spill.

Environmental enhancements.

Construction of refuges (1m deep 5x5m pits or smaller) in deepest part of dead-storage area.

Fish passes in spill ways.

Cascade level approaches rely on co-operation of neighbouring communities.

## **The concept of integrated watershed management in the Dry Zone: what does it mean? how should it be approached?**

Key concepts: Participation of the widest section of community – poorer to better off  
Equity – targeting of longer term benefits to poorer section of the community – least likely to benefit from many physical interventions of interventions. Often longer term to NR resources including bio-mass from forests / tanks longer term equity.

Understanding access internal to external. External to internal

The importance of peoples institutions in implewatershed management: Planning, implementation, managing.

## **Integrated watershed management models in India: Video – 30 mins.**

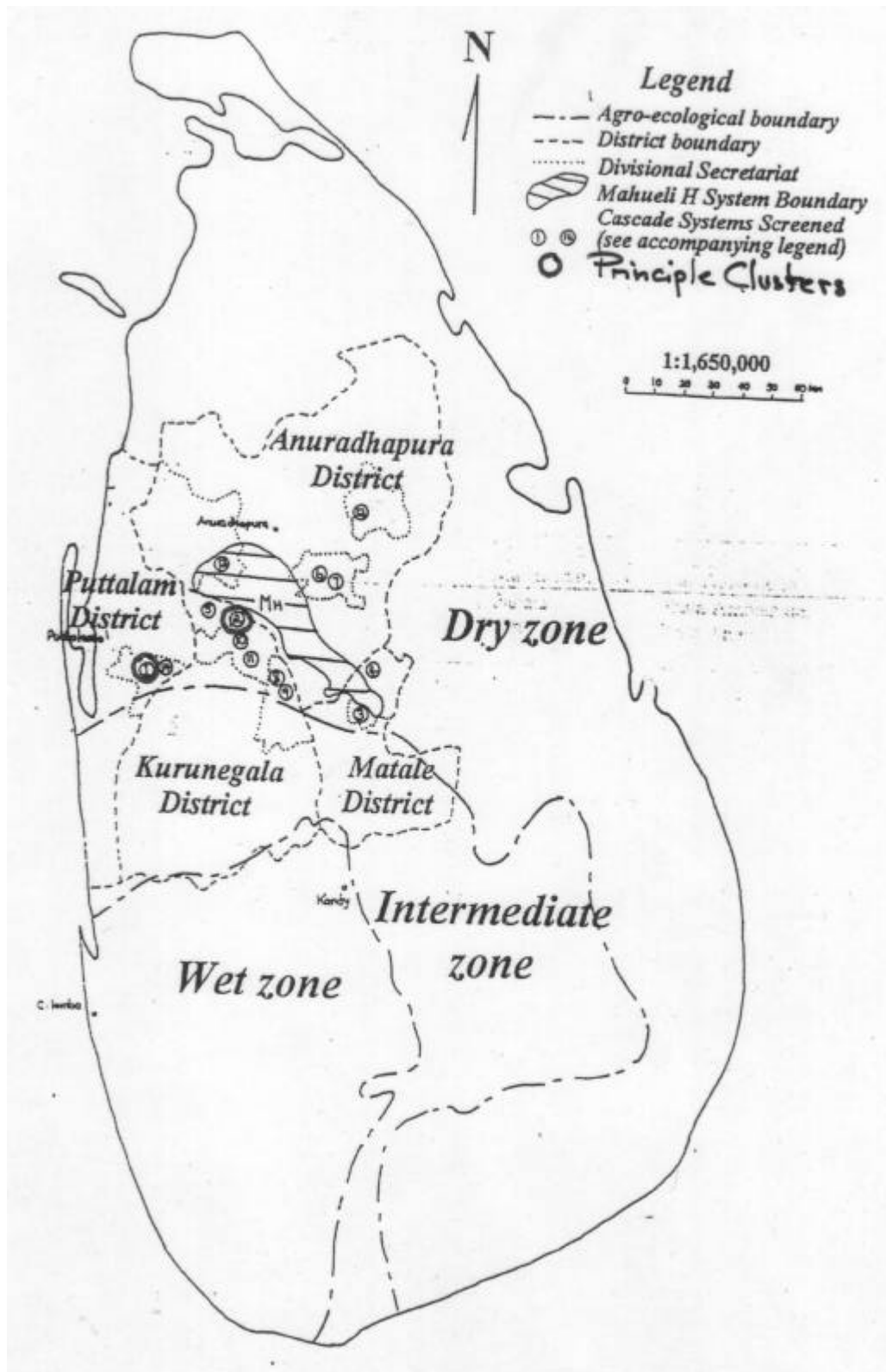
Participant feedback

### **References:**

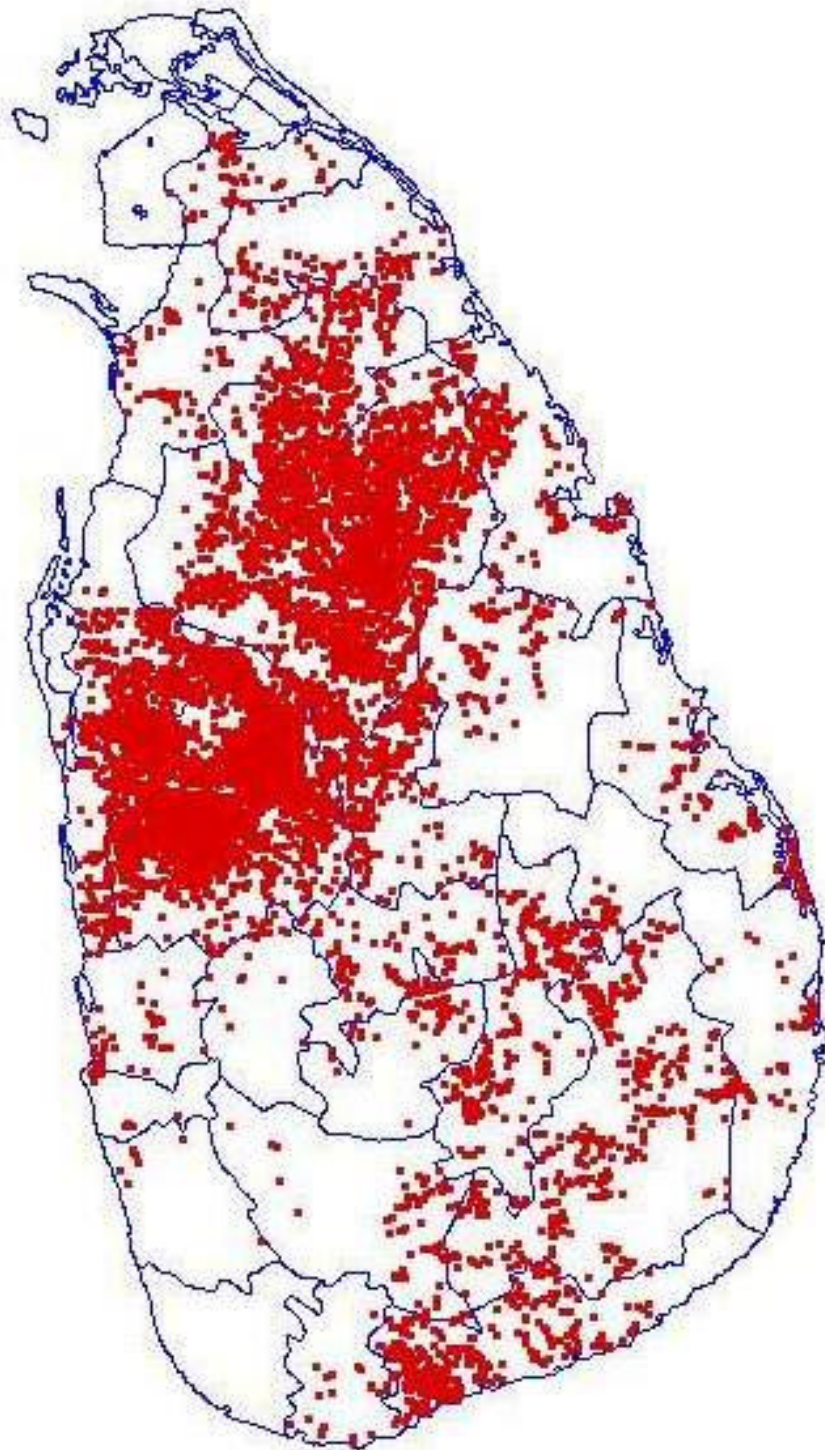
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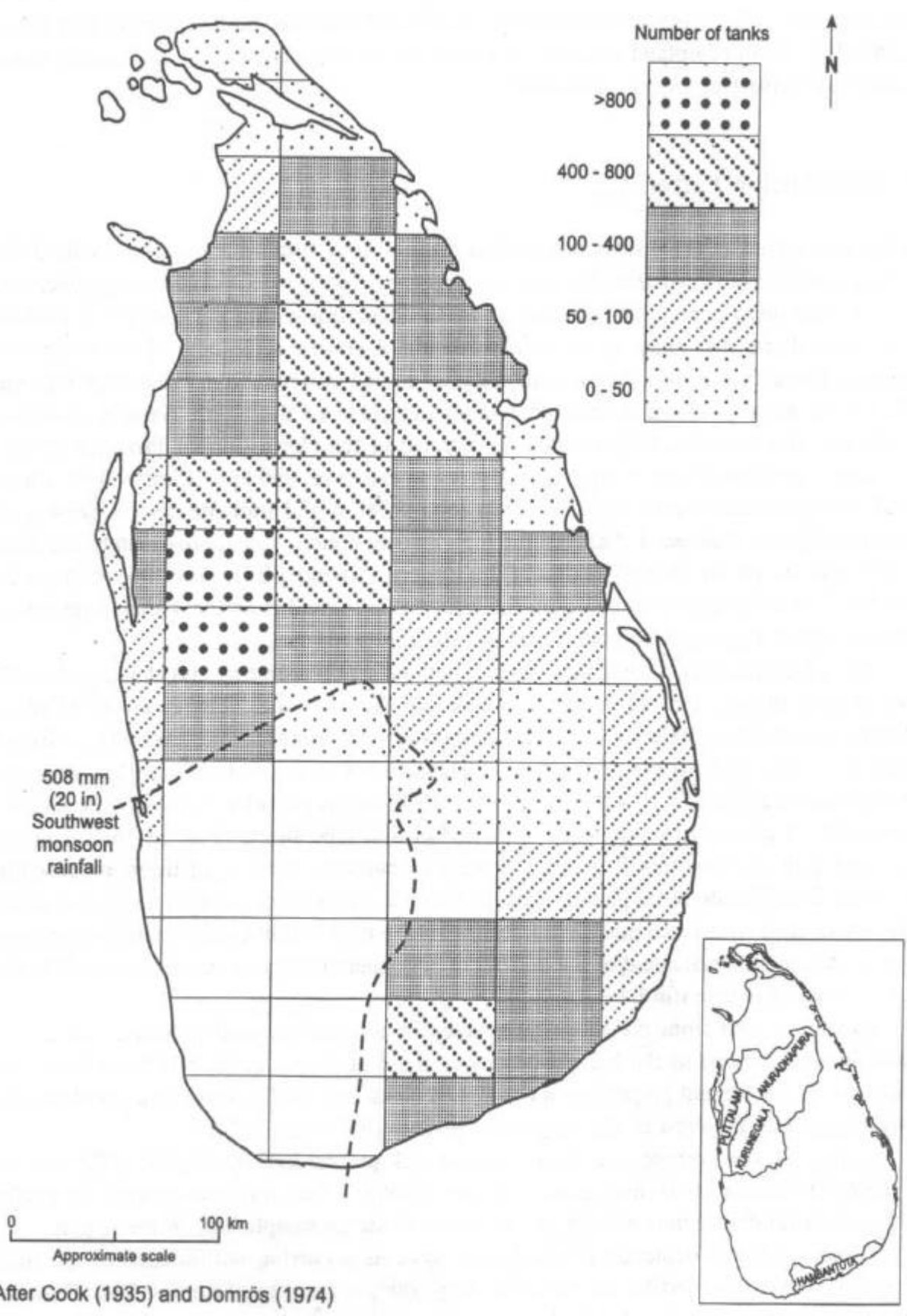
**Fig 2: Map showing location of research areas**



**Fig 3: Map showing distribution pattern of minor tanks in Sri Lanka (Agrarian Services Department GOSL 2002).**



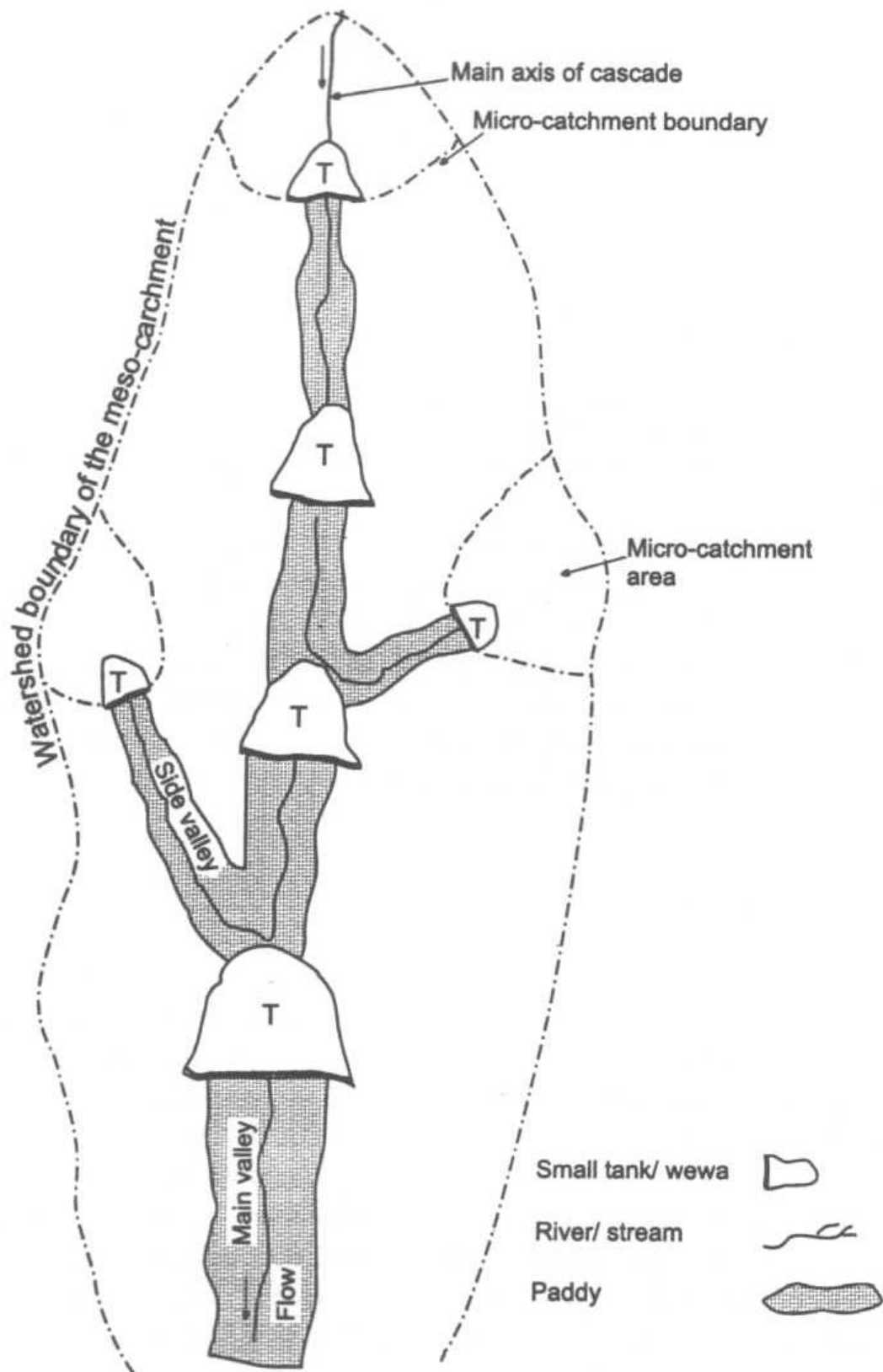
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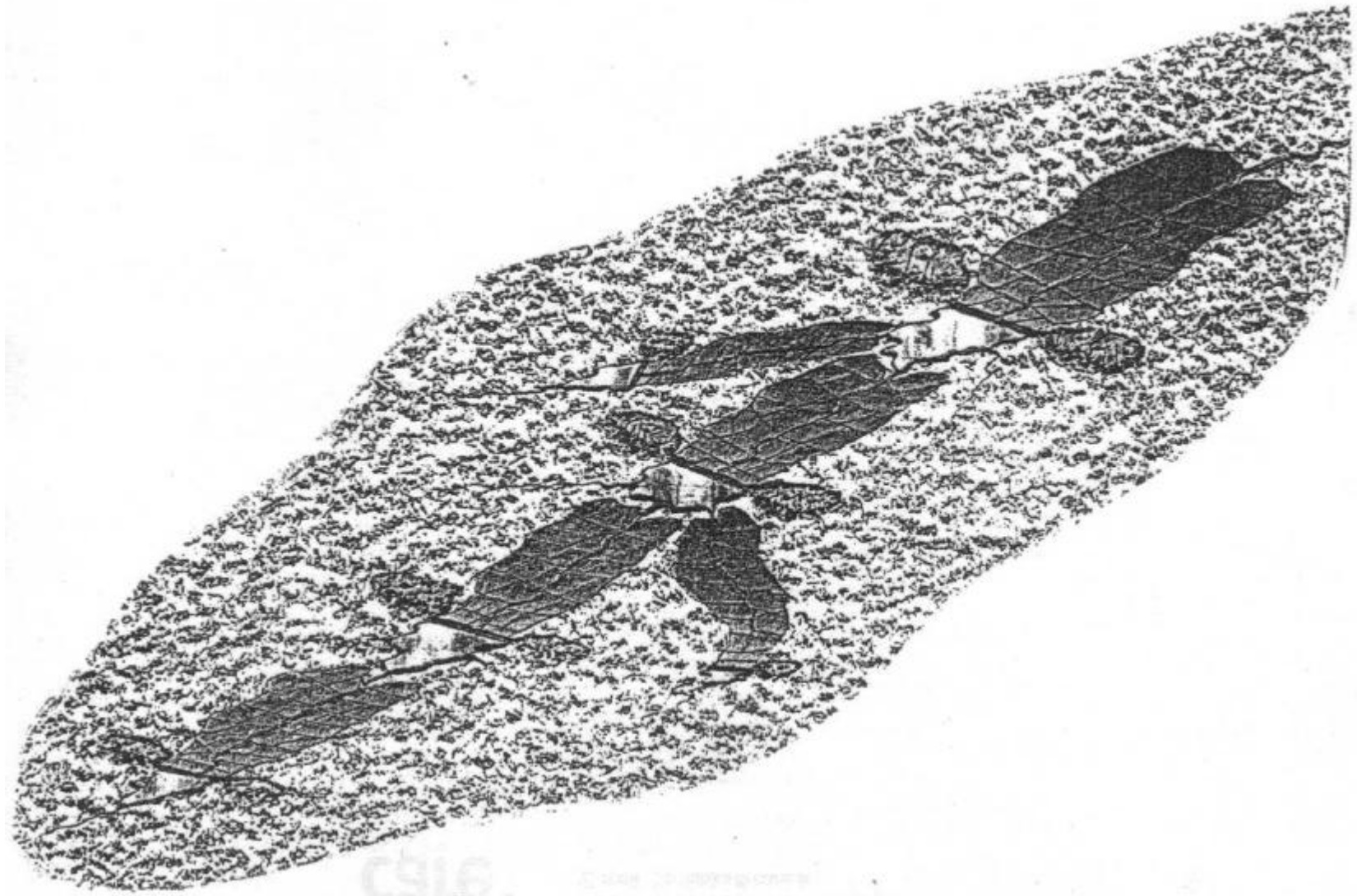
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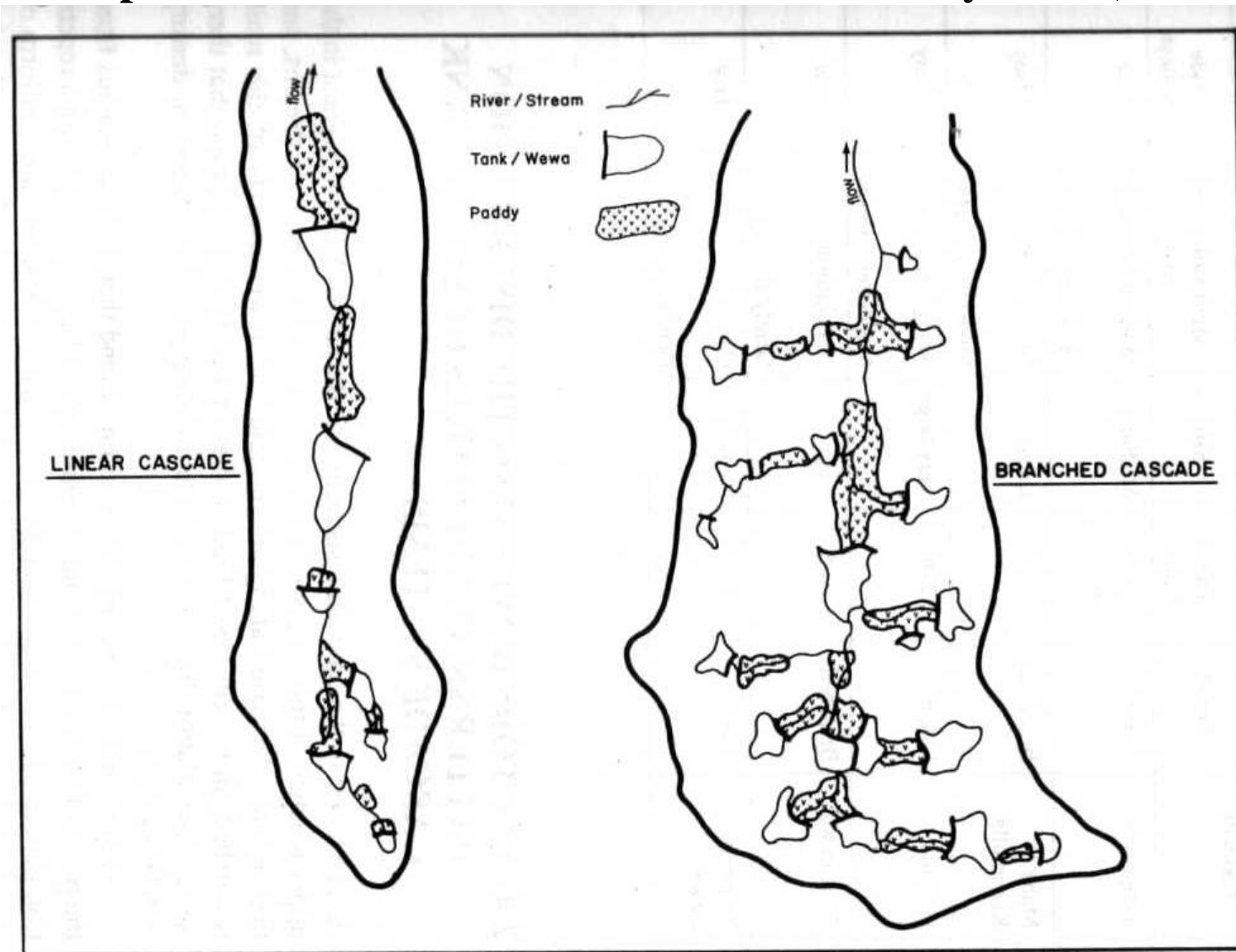
**Fig 6: Schematic of a simple linear cascade  
(Panabokke et al 2002)**



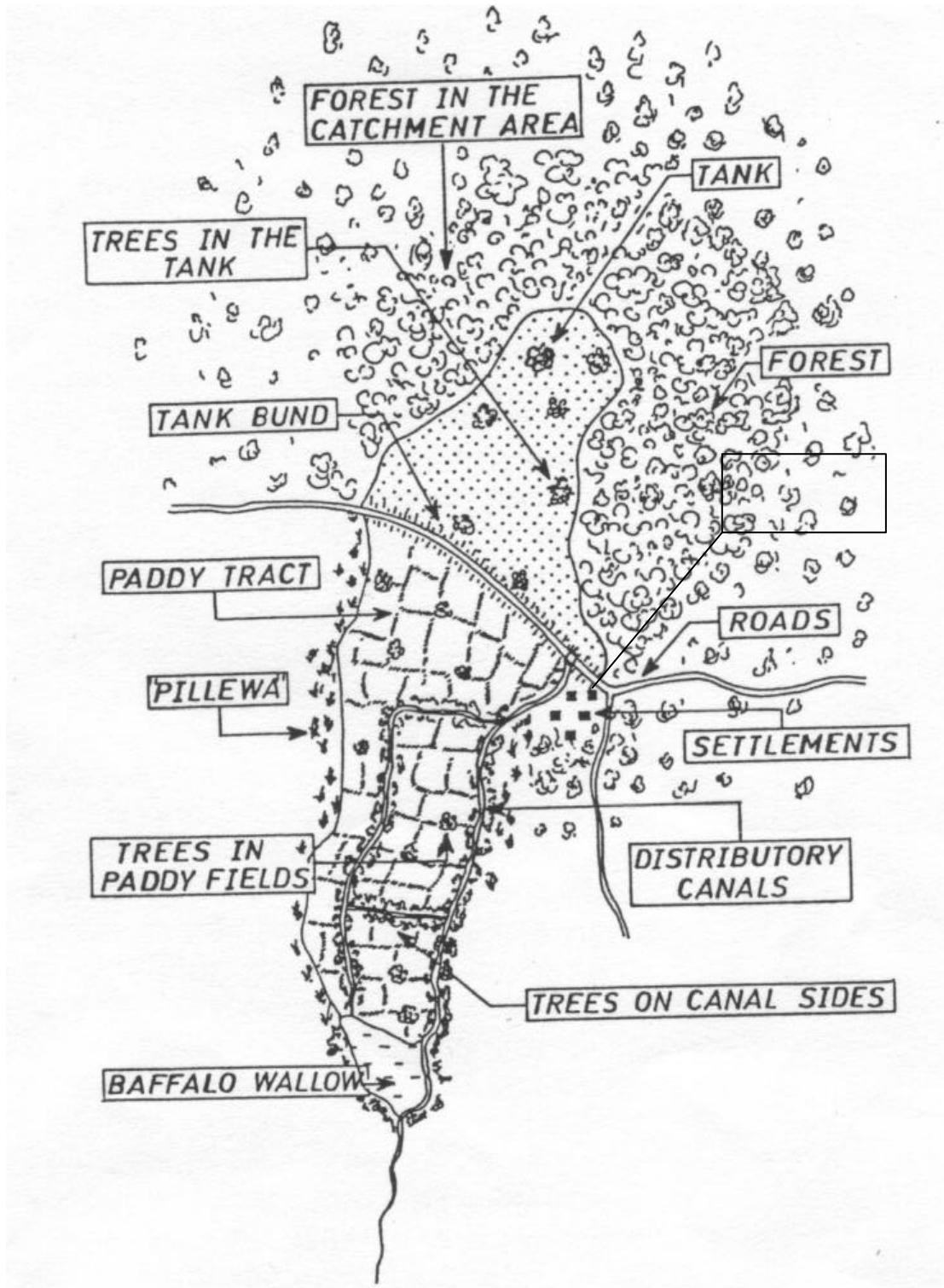
**Fig 7. Pictorial view of a simple linear cascade system (Sakthivadivel *et al* 1996)**



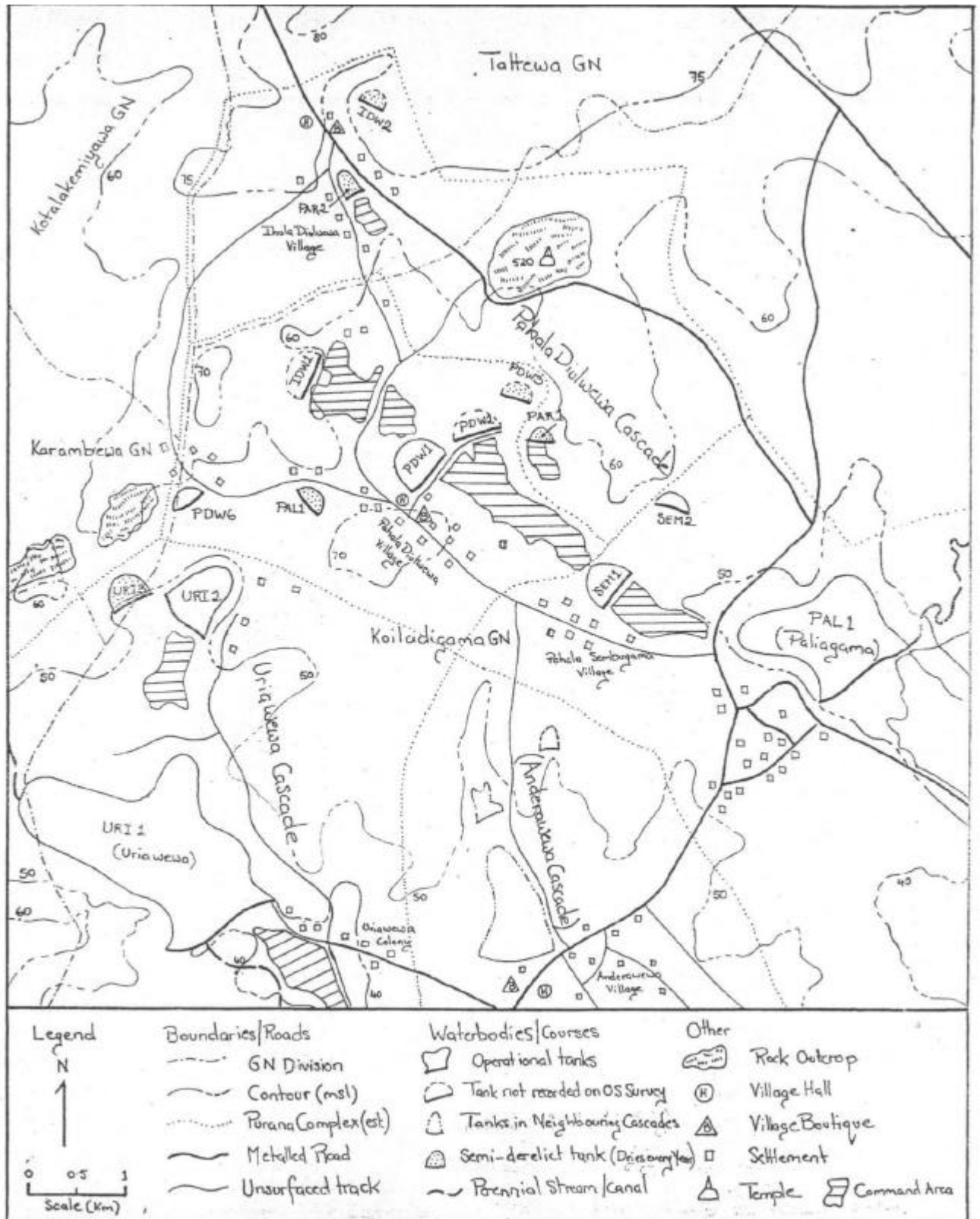
**Fig 8: Schematic representation of linear & branched cascade systems (Sakthivadivel 1996)**



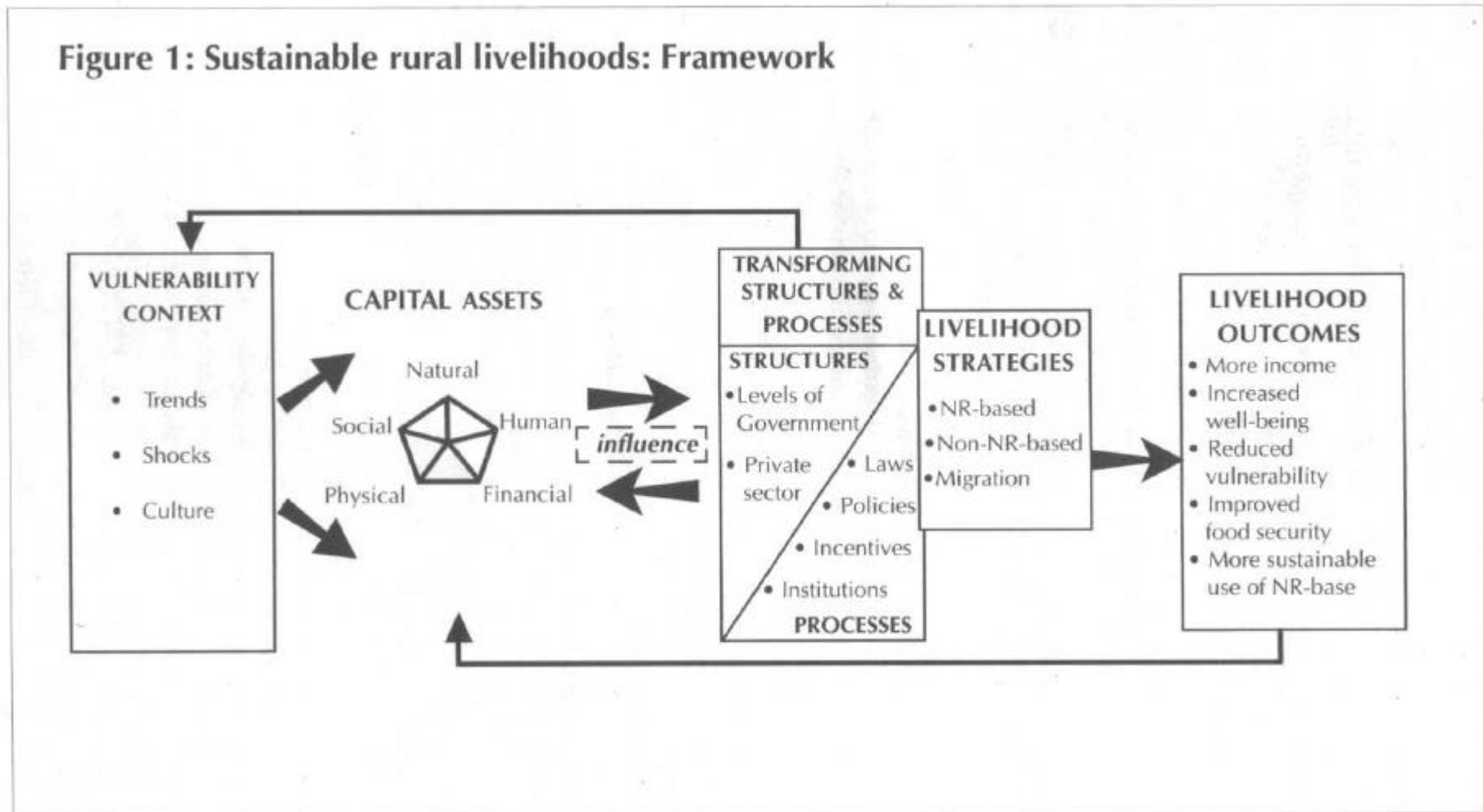
**Fig 9: General layout of a village tank (Ulluwishewa 1991).**



**Fig 10: Map of Pahala Diulwewa cascade system, Puttalam District NWP (Murray and Little 2000).**



**Fig 11: The livelihoods framework (Carney 1998).**



**Fig 12. Seasonal livelihood calendar (farmers) and inland fish market trends, Galgamuwa and Anamaduwa Districts, Sri Lanka, 1998-99.**

Month	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	
<b>Weather Cycle</b>	NE Monsoon							SW Monsoon & 'Warakan' Winds					
<b>Rainfall</b> (Total Annual 950-1,350mm)													
<b>Perennial Tank Water availability</b>													
<b>Cultivation season</b>	Yala (main cultivation season)				Dry		Yala (minor cultivation season)				Main Dry season		
<b>Paddy cultivation</b>	Field Preparation & Sowing		<b>Irrigation</b>		Harvest		Field Prep & sowing		<b>Irrigation</b>	Harvest			
<b>Dryland cultivation</b>	Sowing		Harvest		Fallow period						Field Preparation		
<b>Off-farm labour</b>	++	++	++		+++	+++						+	
<b>Income availability</b>	---	--	+	--	+	+++	++	+	+	-	--	---	
<b>Inland fish availability</b>													
<b>Comments on availability</b>	NE monsoon: Large fish rise. Highest catch during spill.			Max water spread: Lowest catch						High water & Winds impede netting		Lowest water – highest catch of small varieties	
<b>Inland fish demand</b>	++			+		++++ Harvest & New Year			++		+++ (Esp. for small varieties)		
<b>Price of Inland fish</b>	+++		+	+++	++		++++		++		+		
<b>Marine fish availability</b>	++++								++		++ (small varieties)		

Figure 11: Principle marketing chains for inland fish in Northwest Province Sri Lanka.

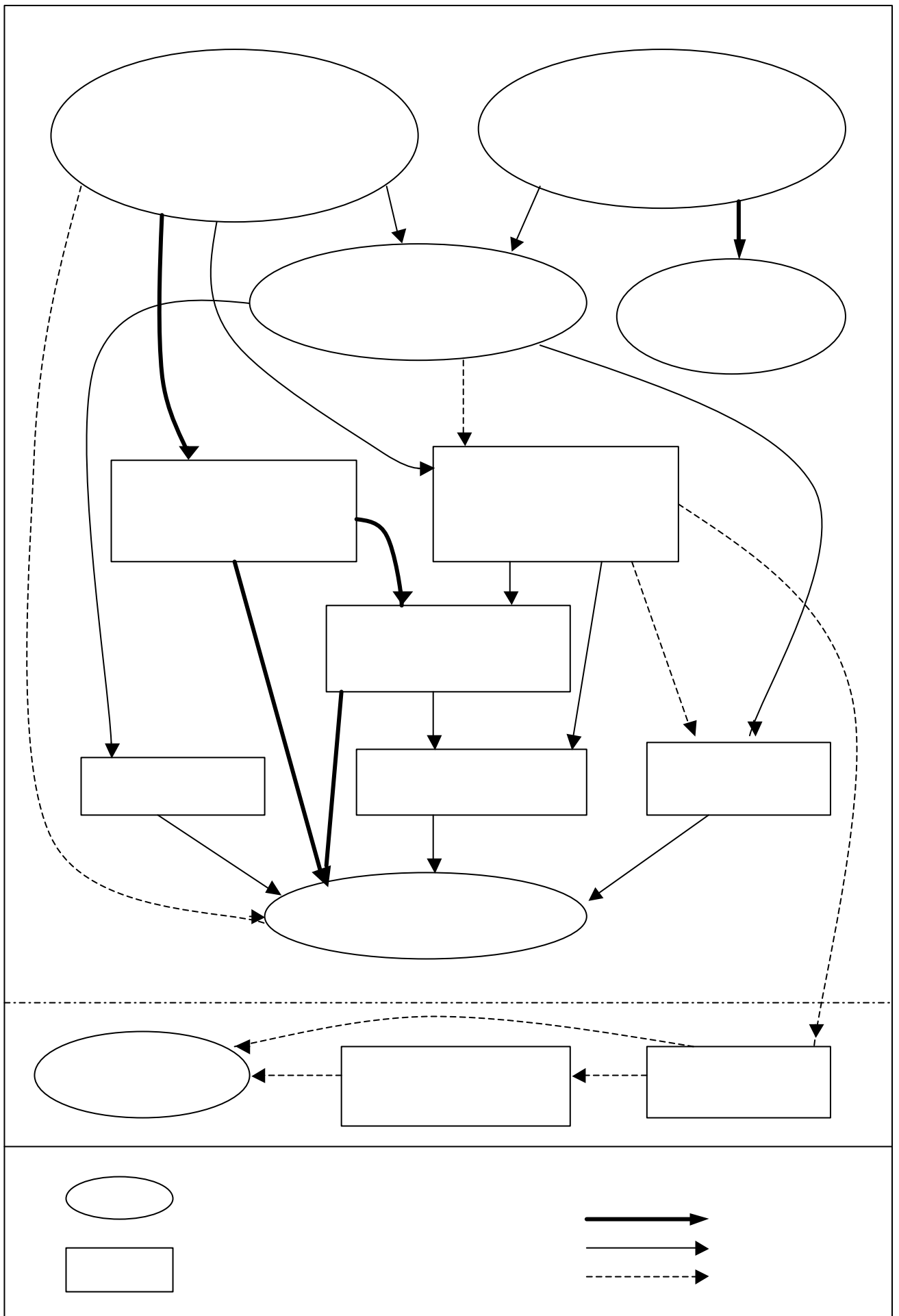
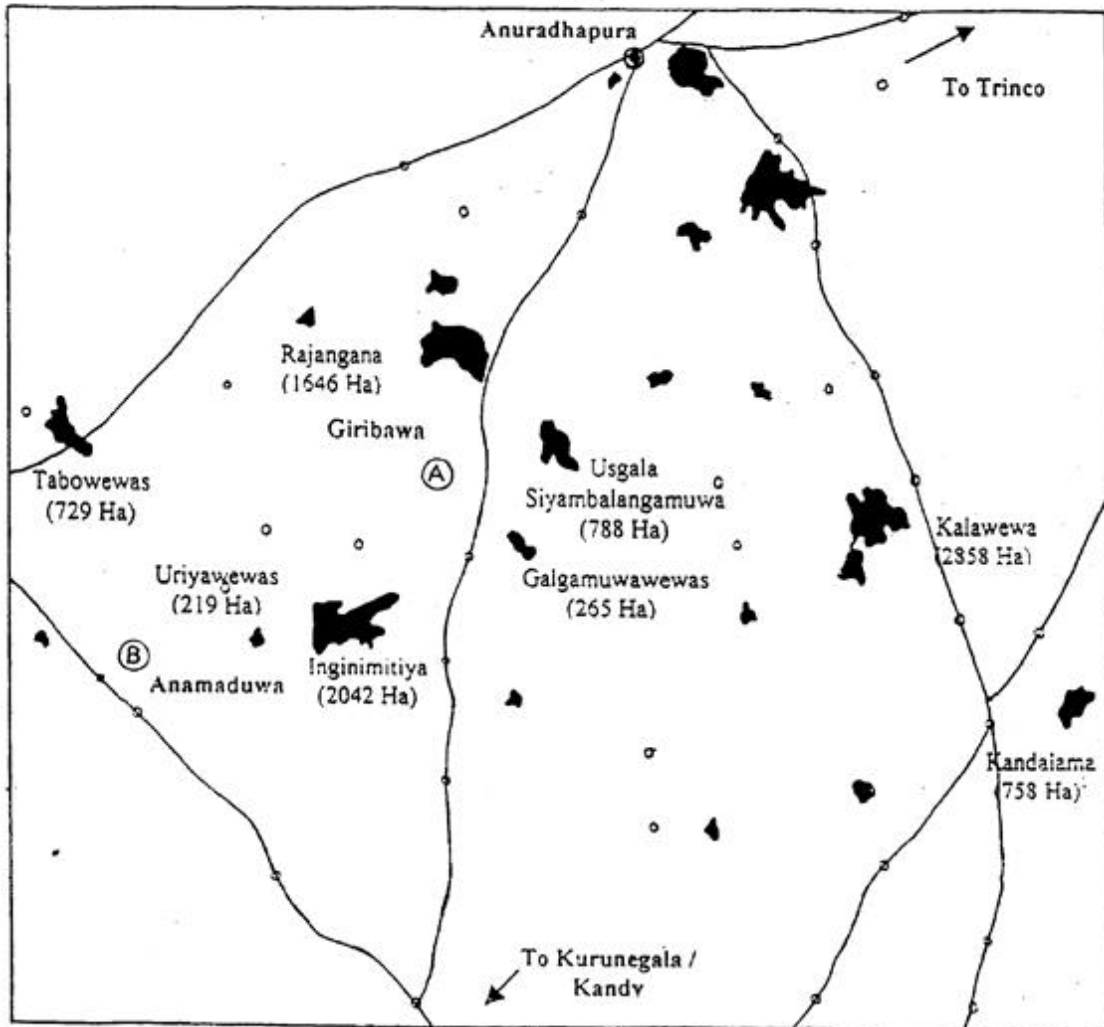


Fig 14: Map showing location of research areas and major reservoirs with important commercial fisheries (Murray and Little 2002)



Legend

- Small service centres ○
- Provincial capital ⊙
- Reservoirs >100ha FSL ▲
- Major surfaced roads ~
- Danduwelawe cascade system (A)
- Pahala Diulwewa cascade system (B)



Fig 15: Fishing mobility chart Pahala Diulwewa Cascade, Puttalam District NWP

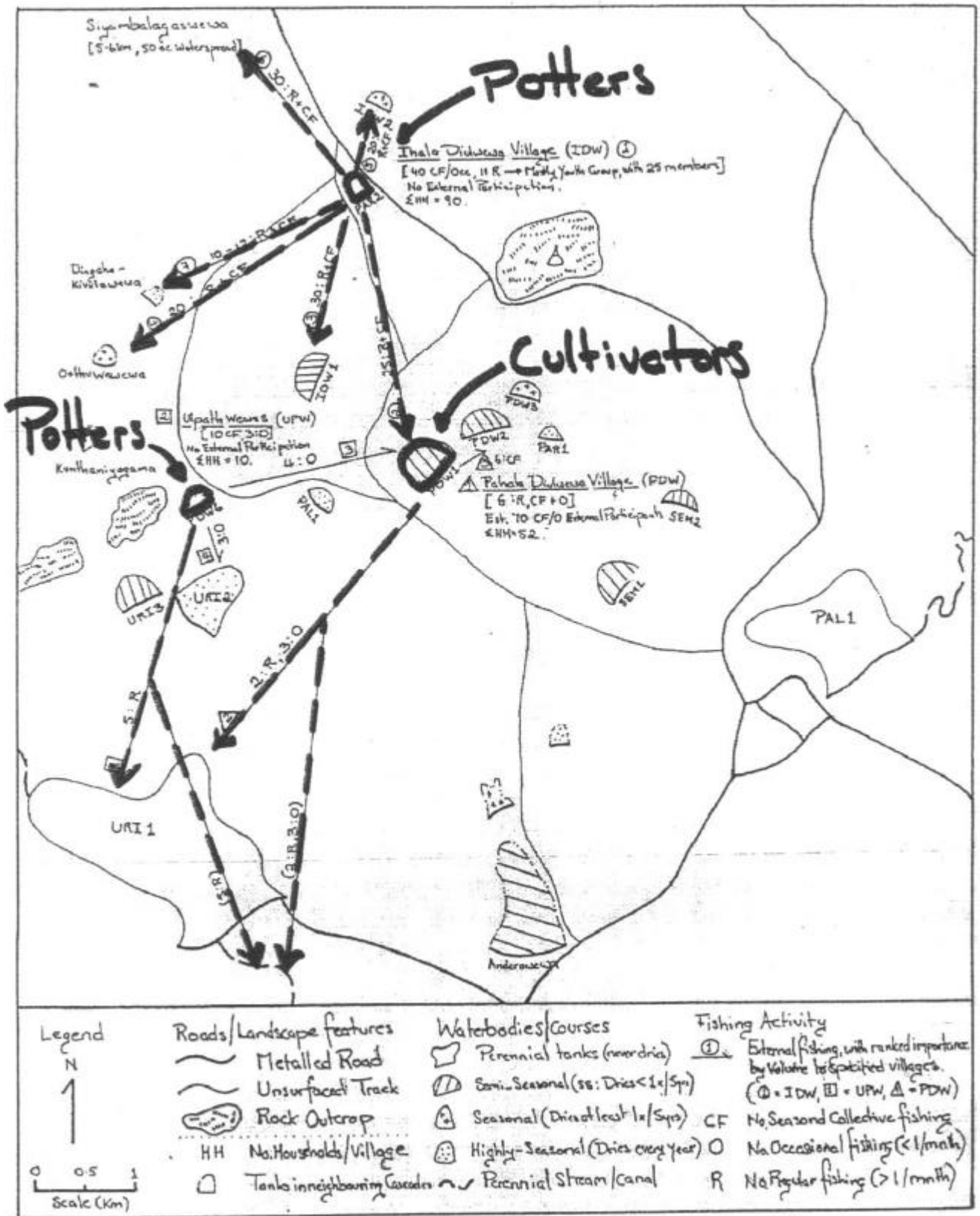


Table 1: District-wise distribution of seasonal tanks (<80 Ha command area) in the Dry Zone of Sri Lanka (Excluding North and Eastern Provinces - DAS 1996)

District	Max Tank Area (Ha)				Total Ha		Families '000s
	<10	10-50	50-100	>100	Water	Command	
A'Pura	201	1,573	466	241	2,481	99,950	53.6
Polo'wa	8	67	30	15	120	6,215	2.85
Putallam	254	421	51	26	752	21,000	16.4
Kur'la	2,040	1,954	203	45	4,442	73,850	85.4
Dambulla	35	44	8	1	78	515	1.15
Mon'gala	37	130	34	23	224	9,150	5.9
H'tota	107	352	54	19	533	11,100	8.1
Matale	47	197	36	10	290	9,200	9.15
<b>Total</b>	<b>2,739</b>	<b>4,698</b>	<b>832</b>	<b>480</b>	<b>8,920</b>	<b>230,980</b>	<b>182,550</b>

**Table 2: Classification of Cascade Systems 1: By Size....**

<b>Class</b>	<b>Watershed area (ha)</b>	<b>No of axial tanks</b>	<b>Approx. No of households</b>
<b>Small</b>	<b>&lt; 1,000</b>	<b>2-4</b>	<b>300 - 400</b>
<b>Medium</b>	<b>1,000 – 2,000</b>	<b>4-8</b>	<b>400 – 1,000</b>
<b>Large</b>	<b>2,000 – 3,000</b>	<b>8-12</b>	<b>&gt; 1,000</b>
<b>Very large</b>	<b>&gt; 3,000</b>	<b>&gt;12</b>	

Table 3: CPRs & associated livelihood activities in rain-fed areas North Western Province.

Resource?	Uses of Water		Uses of Common Lands		
	Surface water	Ground water	Forest / Scrub	Fallow lands	Tank bed
Livelihood activity?	Village tank Stream	Agro-well Tube-well	Catchment/ Rock outcrops	Paddy/Chenna /Upland	Sand/Silt/Clay
Irrigation					
Bathing					
Domestic					
Livestock					
Brick Making					
Cajun retting					
Fishing					
Cultivation					
Quarrying					
Firewood					
Timber					
Wild Game					

# **Why Watersheds?**

1 Day Workshop – Kurunegala 11 9 00

**CARE, IoA, Peradeniya University**

## **Objectives:**

- 9. What are watersheds / cascades?**
- 10. Tank based interventions & watershed implications**
- 11. Integrated watershed management**
- 12. Watersheds, CPRs & communities**
- 13. Pros & cons of the integrated approach**
- 14. Inland fisheries & rural livelihoods**
- 15. Conflicts / synergies between fisheries and other tank water uses**
- 16. Strategies to improve multi-functional use of tanks.**

Neglected areas in dry -zone development:

**Watersheds – Upstream/Downstream impacts**  
**CPRs - Conflict problems**  
**Caste - Resource access patterns.**

**Group Activity No 1 – 10 mins:**

**Definitions:**

- 1. Rain fed areas?**
- 2. A watershed?**
- 3. A Cascade System?**
- 4. Integrated watershed management?**
- 5. Common Property resources**
- 6. A Dry-Zone community?**

## **1. What are watersheds & Cascade Systems**

- ? Watershed: An area of definite boundary draining to a common reference point.**
- ? Cascade: System of hydraulically connected tanks harnessing & storing ephemeral water in a dry-zone watershed.**
- ? Total Tanks: 18,378 (1:50,000 maps)**
- ? 2-25 tanks per cascade system**
- ? Approx. 3,500 - 4,000 cascades**
- ? DAS Estimate 9,000 operational**

### **Factors determining distribution density?**

- ? Rainfall quantum and distribution**
- ? Underlying geology - permeability**
- ? ?Geomorphology (2-4% slopes retentive water table)**

Hydrological Endowment

**Better endowed cascades:**

? **Linear to slightly branched form**

? **Area to length ratio  $>1.5$**

? **Gently sloping gradient on main axis**

## **Intra – watershed variations:**

? **Upper watershed / Radial tanks**

? **Prone to higher seasonality**

? **Supplementary irrigation / risk**

### **Seasonality:**

? **Highly - Dries every year**

? **Seasonal - Dries once per 5yrs**

? **Semi seasonal – More than once per 5yrs**

? **Perennial - Not in recent memory**

## **Simple methods of hydrological assessment:**

? **Ratios of catchment, storage capacity and command area**

? **Cropping intensity**

? **Spill frequency.**

**Concept: Deficit & surplus cascade systems.**

## **2. Tank based interventions and watershed implications:**

### **Principal (ideal) functions:**

- ? ?Equity in water distribution – below average Rainfall years**
- ? Regulating flow volume – bund breaching & soil erosion**

### **Reality?**

- ? Historically - Good individual tank perceptions of WS management**
- ? Poor Cascade level – farmers & planners**
- ? Hydrological impacts – shifting water deficits?**

**Mid 80's – First identified need for integrated cascade level approaches**

- ? Adoption??**

Tank rehabilitation definitions:

? **Restoration of abandoned tank**

? **Restoration of non-working tank**

? **Improvements to working tank**

? **Maintenance of working tank**

Impacts of increasing storage capacity

? **Reduced spill events:**

? **Downstream – water deficit**

? **Upstream - fish recruitment**

? **Increased bund/spill height**

? **Flooding of upstream command area**

? **Desilting – Increased dead storage – cost!**

### **3. Integrated watershed management?**

**Increasing focus on integrated approaches at the individual tank level – why watershed?**

#### **Group activity 2 - 10 mins**

**Cascade level linkages:**

**Agro eco-system**

**? Upstream resource flows?**

**? Downstream resource flows?**

**Socio-economic**

**? Socio/cultural linkages?**

**? Institutional linkages?**

**? Economic**

**Some examples of cascade resource flows.**

*Upstream resource flows:*

- ? **Fish migrations during spills**
- ? **Disease during spills (EUS)**
- ? **Salvenia with fishnets and livestock**
- ? **Manure inputs from Livestock**

*Downstream resource flows*

- ? **Fish migrations during spills**

*?? Surface and ground water*

- ? **Soil from degraded catchments**
- ? **Organic materials from catchments**
- ? **Agro-chemical pollution**
- ? **Manure inputs from livestock**
- ? **Salvenia during spill events**

## **4. Watersheds, CPRs & Community**

**How do we define a community / boundaries?**

**? Shared socio-economic-cultural factors**

**? Shared access to a resource base(s)**

**? Physical boundaries (i.e. watershed)**

### **2 Principal rural settlement forms:**

**1. 'Irrigation colonies' - Contemporary**

**2. Purana Villages - Traditional**

**? 1-2 Larger perennial / semi-seasonal tanks**

**? Up to 13 radial tanks – Horizontal spread**

**? Bound by caste and kinship**

**The 'Purana Complex'**

## Feudal Caste system

? **>50 % dominant cultivator caste**

? **Still no intermarriage**

? **CPR access limits perpetuated**

**Low caste marginalisation :**

? **Upper watersheds / productive resources**

? **Highest dependency on seasonal OF labour**

? **Highest dependency CPRs – unsustainable!**

Linkages?

? **CBRs: DDS**

? **External institutions: Samurdhi, GN, GSN**

? **FOs: Main responsibility for tank resource**

? **But: Often poor representation within PC!**

5. Pros and cons of the integrated approach

**Pros:**

- ? **Improved ability to forecast +ve and –ve impacts of interventions on different uses and users of resources**
- ? **Choice of most suitable scale for cost effective targeted development.**
- ? **Fuller understanding of ecological, economic, social aspects of livelihood systems increases potential sustainability**

**Cons:**

- ? **Complexity of holistic approach: Time, cost, interdisciplinary skills**
- ? **Logistical: Planning v implementation**
- ? **Willingness to adopt v more jargon**
- ? **Inability to overcome community barriers**
- ? **Inclusion of poor and better off groups.**

## **Role of inland fisheries in rural livelihoods**

### **Protein consumption:**

- ? 70% per capita animal protein consumption**
- ? Marine fish: Urban areas & arterial routes**
- ? Inland fish: Rural areas**
- ? Dried fish: Imported marine fish**
- ? Inland fishery: 90-95% exotic tilapia**
  - ? Cheap**
  - ? Exceedingly fresh (handling)**
  - ? Relatively flat production**
  - ? Highest during dry season**

**‘ Fish is so cheap we substitute it for vegetables during the dry season!’**  
**Inland fisheries and income generation:**

## **2 Sectors:**

### **1. Commercial / Perennial**

**? 90% recorded production - 74 major tanks**

**? >200 ha full-time fishermen**

### **2. Subsistence / Seasonal**

**? Off flavours – Soapy muddy**

**? Highly seasonal: bathing/ irrigation priority**

**? Lack of gears – low water**

**Potentially most productive, but**

**? Seasonality (<6 months 20-30kg)**

**? Cyclical impediments to recruitment**

**? Giribawa; Last spill 1998**

Constraints and opportunities for income generation inland fisheries in seasonal tanks

- ? **Low urban demand & low potential for product diversification**
- ? **Growth at any cost or redistribution 1<sup>st</sup>?**
- ? **Niche market for large exotic carps, but:**
- ? **Poor handling**
- ? **Require seed – Ornamentals**
- ? **Community based production 200-800ha?**
- ? **Free riding**
- ? **Lack of vertical horizontal integration**
- ? **Risk of excluding current users**

**Smaller seasonal tanks – low input enhancement of capture fishery... cohesion...**

**7. Conflicts / Synergies between fisheries and other tank uses.**

Understanding priorities of different water users and compatibilities of different uses:

- ? **Consumptive v non consumptive uses**
  - ? **Irrigation – Dead storage pump down!**
- ? **Water quality modifiers**
  - ? **Irrigation, bathing, fishing, Livestock,**
- ? **Main priorities: irrigation & bathing followed by livestock**
- ? **Fishing – one of lowest priorities**
- ? **Seasonal variation in priorities**

## **Scale of conflicts:**

### **Within PCs**

**? Ignoring the ban**

**? Inviting external friends**

**Between PCs – ‘Poaching’**

**? ? Often tolerated at low level – do nothing?**

### **Potential Synergies:**

**Collective activities can improve both village cohesiveness and wider management of CPRs**

**Traditional village-level collective activities**

**? Bethma system**

**? Shrimadana: Socio-religious**

**? Catchment forest management**

**? Collective fishing**

? **Formally: Highly equitable, sustainable**

? ? Current status: Triggered by events, which reduce water quality for bathing.

? ? No formal organisation or distribution

? **As reward for collective participation?**

Potential for wider collective action?

? **Transhumance strategies in NERS?**

? **Reciprocity between resource management and exploitation within and between neighbouring communities?**

? **Next stage?**

## **Other fisheries options:**

High input / output systems

? **Community based fingerling production**

? **Increased risk and potential value**

? **Potential exclusion and conflict**

*Low input enhancements.*

?? **Local broodstock / fry movements to seasonal tanks.**

? **Stocking strategic axial tanks**

? **Early (Pre) or post spill stocking?**

? **Fish refuges: Pits and brush parks**

? **Fish passes in spill-ways**

? **Minimum mesh sizes in semi-seasonal tanks**

## **8. Strategies to improve multi-functional use of tanks / cascades.**

**Integrated watershed management models in India – 24 min video.**

**Key issues:**

- ? Participation of widest section of community**
- ? Importance of equity**
  - ? NR Biomass extraction and the poor**
- ? Understanding external and internal access**
- ? Peoples institutions in watershed management**