Scale, perception and resilience in Gorongosa, Mozambique

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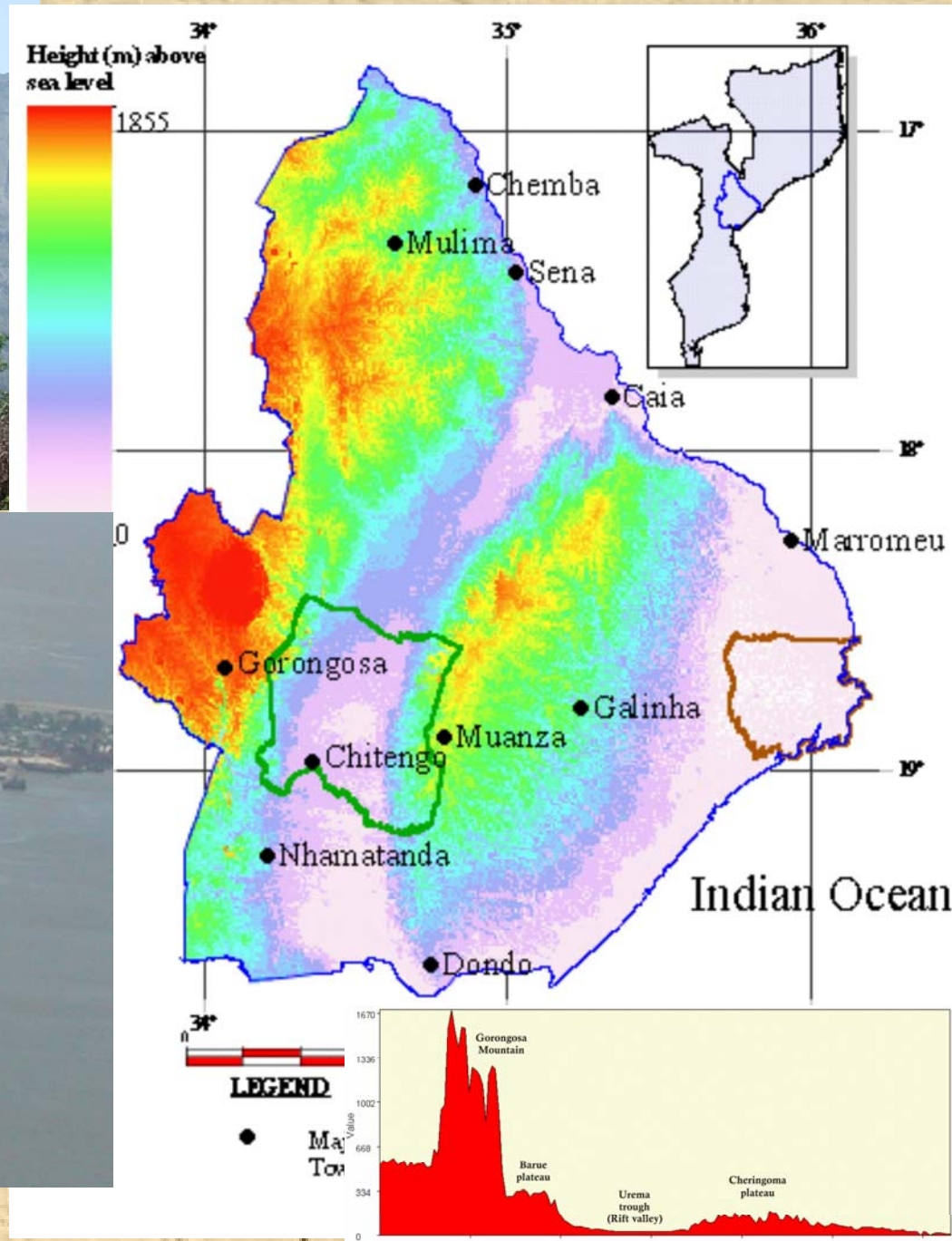
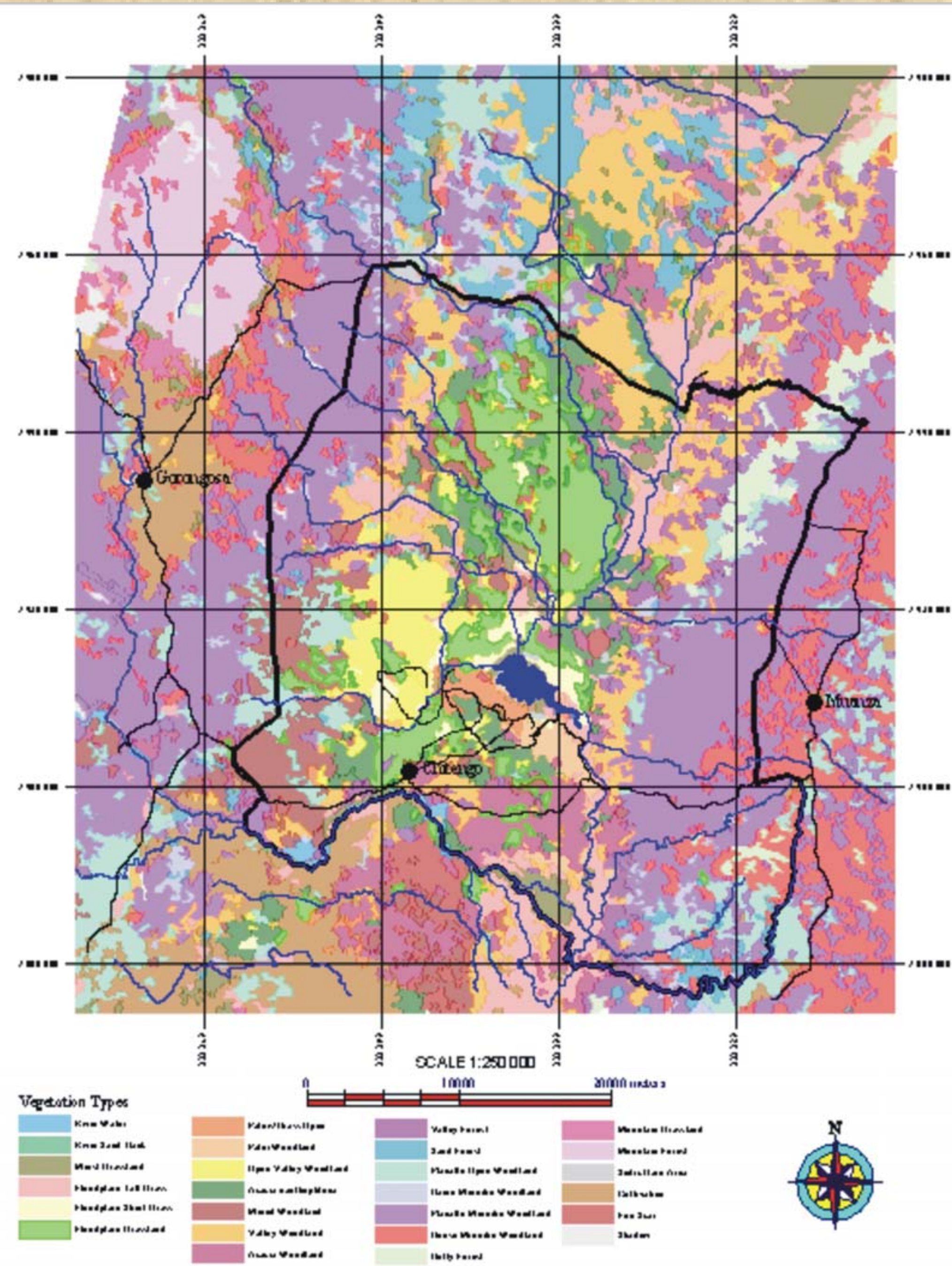
CSIRO Sustainable Ecosystems

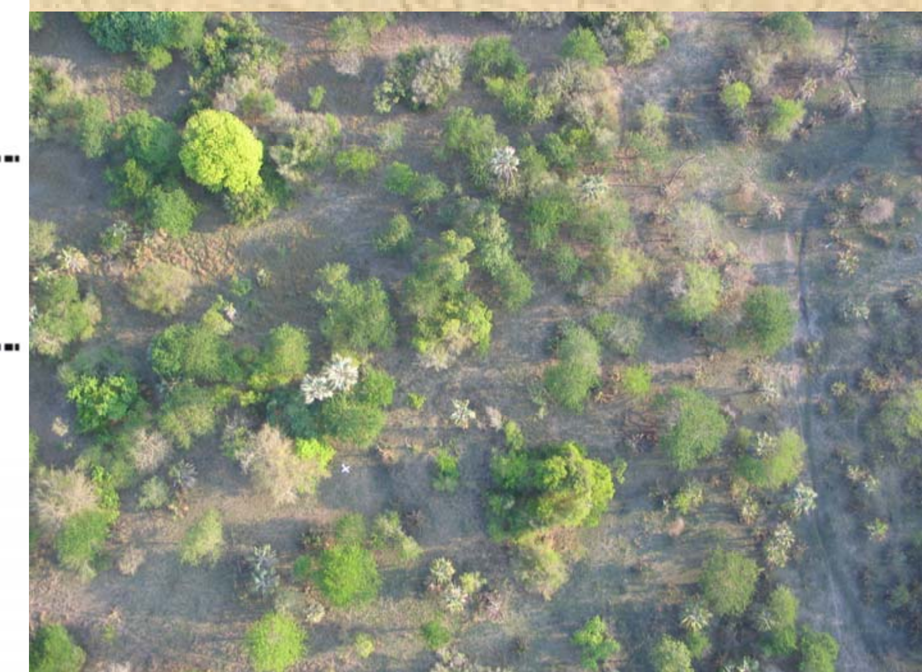
THE RESILIENCE ALLIANCE

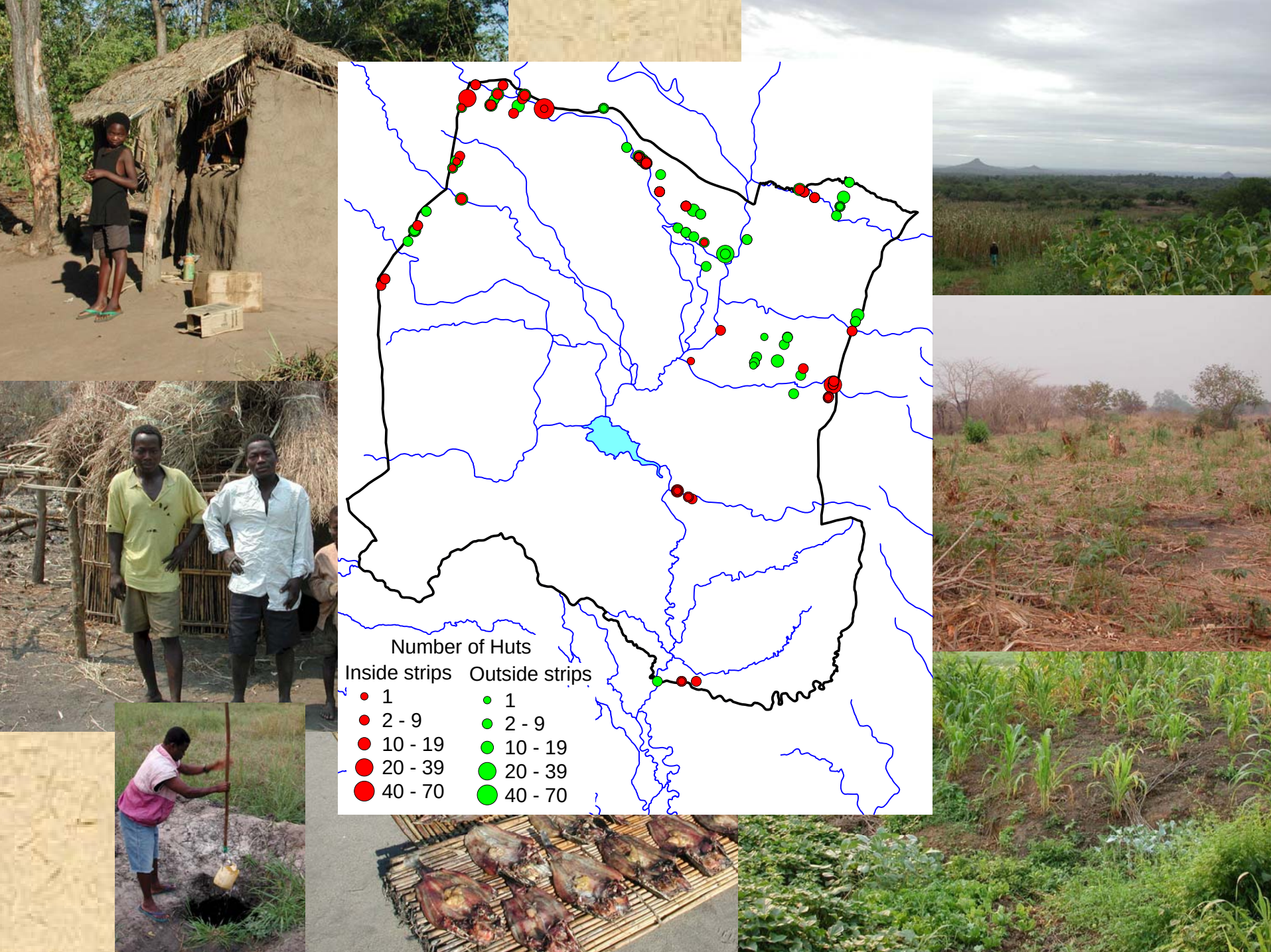
Summary

- Overview of Gorongosa
- Timeline of key changes and events
- Discussion of resilience analysis
- Key messages


Height (m) above sea level
1855
34°
35°
36°
17°
18°
19°
Chemba
Mulima
Sena
Caia
Marromeu
Gorongosa
Galinha
Muanza
Chitengo
Nhamatanda
Indian Ocean
Dondo
LEGEND
Gorongosa Mountain
Barue plateau
Urema trough (Rift valley)
Cheringoma plateau
Value
Distance (meters)
1670
1336
1002
668
334
0
33334
66668
100002
133336
166670
200004


SCALE 1:250 000
0
10000
Vegetation Types
N




Number of Huts
Inside strips
1
2 - 9
10 - 19
20 - 39
40 - 70
Outside strips
1
2 - 9
10 - 19
20 - 39
40 - 70

Species	2004			
	Number seen	Estimated population number	Density (km^{-2})	Confidence interval (%)
Waterbuck	426	4106	1.93	85
Reedbuck	186	1793	0.84	41
Nyala	12	116	0.06	149
Oribi	55	530	0.25	42
Sable	27	260	0.12	129
Zebra	0	0	0	-
Hippo	2	19 [a]	0.01	131
Buffalo	0 [b]	0	0	-


11 7 2001


PARQUE NACIONAL
DA
GORONGOSA

Social and political timeline

Prior to 1975 (Independence):

Low social equity.
Colonial capitalism.
Private tenure.
Little investment in education.
Little participation in political process by the majority.
Proclamations of protected areas (e.g. GNP).

Independence to 1982:

Redistribution of wealth.
People's power (Socialism)
Land tenure – ownership reverts to state.
Increased access to education.
Greater political participation.
Change in the constitution.
Dismantling colonial structures: Social memory – records, Governance and legislation, Economic systems.
Nationalisation – property and infrastructure.
Beginning of civil unrest.

1982 - 1992 Civil war:

Massive destruction of infrastructure.
Resource destruction and uncontrolled use / harvest.
Increase in corruption.
Break down in law and order.
Collapse of formal economy and shift to informal market system.
1992 – Peace accord.

1992 – 2003 Capitalism:

Change to democracy with new constitution.
Free markets.
Increase in investments.
Revisions to the constitution.
Massive returns of displaced people.
Land tenure shift to local communities.

Resource use

Prior to 1975 (Independence)

Limited access to land.
Resource use limited to power class.
Abundant resources.

Independence to 1982

Access of land and resources for all.
Massive exploitation of resources – open access.
Wasteful use of resources.
Parastatals mean state controlled access and use.

1982 - 1992 Civil war

Forest exploitation reduced.
Wildlife use increased.
Completely open access.

1992 – 2003

Dramatic increase in the use of forest and wildlife resources.
Reorganisation of legislation.
Increased investment.
Unplanned development.
Return of displaced people but with disorganised resettlement.
Land invasions.

Ecological events

Droughts
early 1980's, 1982-1985
1991 / 92

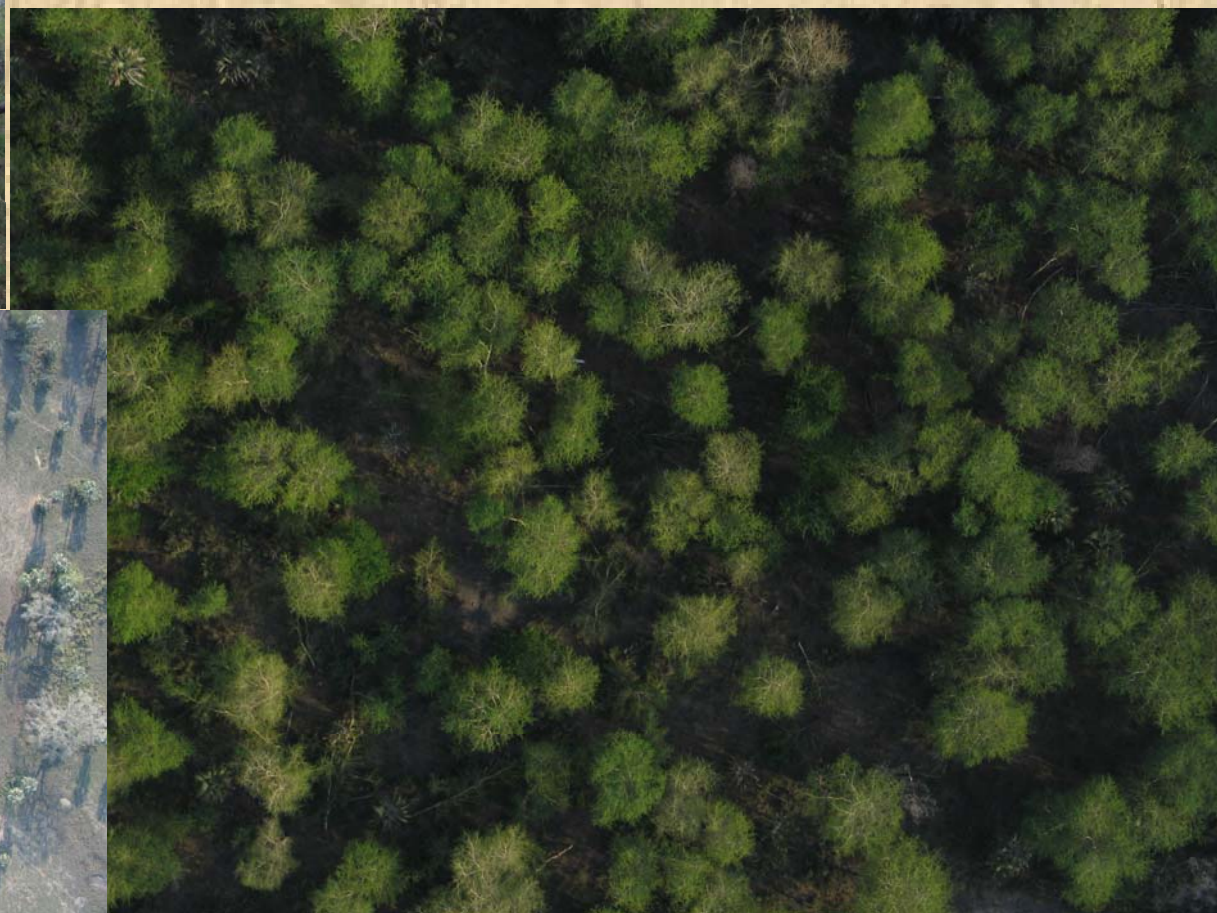
Floods
1997 Pungwe River
1999 Save River
2000 Zambezi River, cyclone

Other
1920's to 30's Rindepest.
1965 to 1973 Development of GNP infrastructure.
1970's Inchope to Caia road built.
1975 to 1983 Large scale wildlife culling. 4000 buffalo per year from Marromeu and GNP.
1983 to 1987 Destruction of wildlife by FRELIMO / RENAMO / ZNA.
1992 to 1994 Destruction of wildlife - high impact with poaching for markets.
2003 Inchope to Caia road rehabilitated.

So, is it resilient?

It depends on the scale of analysis and our perceptions….

Ecosystem indicators - vegetation



Ecosystem indicators - wildlife

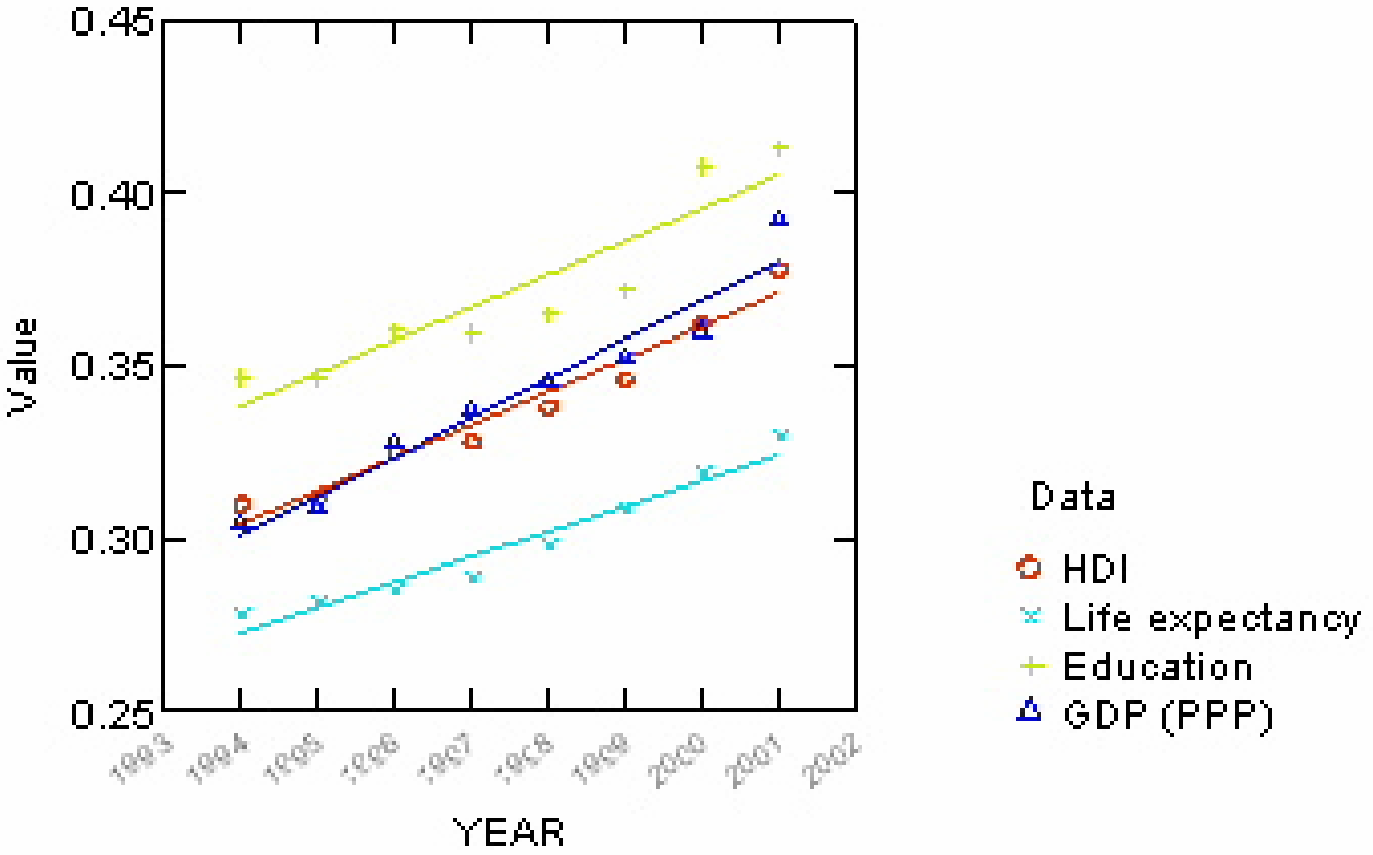
	1978	1994	2000	2004
Elephant	1600	108	163	0
Buffalo	10000	0	0	0
Waterbuck	2079	129	508	4106
Zebra	3328	65	19	0
Reedbuck	33	344	260	1793
Impala	2898	0	53	NA
Hippo	3483	0	50	19

Ecosystem indicators - hydrology

Human indicators

Resource	1975	2002	Change
Soil quantity	20	18	-2
Soil quality	30	10	-20
Number of trees	20	10	-10
Number of tree species	14	11	-3
Size of trees (diameter)	15	5	-10
Amount of grass and herbs	20	20	0
Number of species grass and herbs	10	10	0
Wild animals	15	10	-5
Number wild animal species	13	7	-6
Birds	12	12	0
Number of bird species	8	8	0
Number of fish (amount)	16	7	-9
Number of fish species	9	9	0
Amount of water in rivers	16	6	-10
Quality of water	7	7	0
Depth to water in wells	5	13	8
Water quality in wells	6	6	0
Rainfall amount	30	40	10
Rainfall timing			0
Rainfall variability	11	16	5

Human indicators - HDI



Resilience

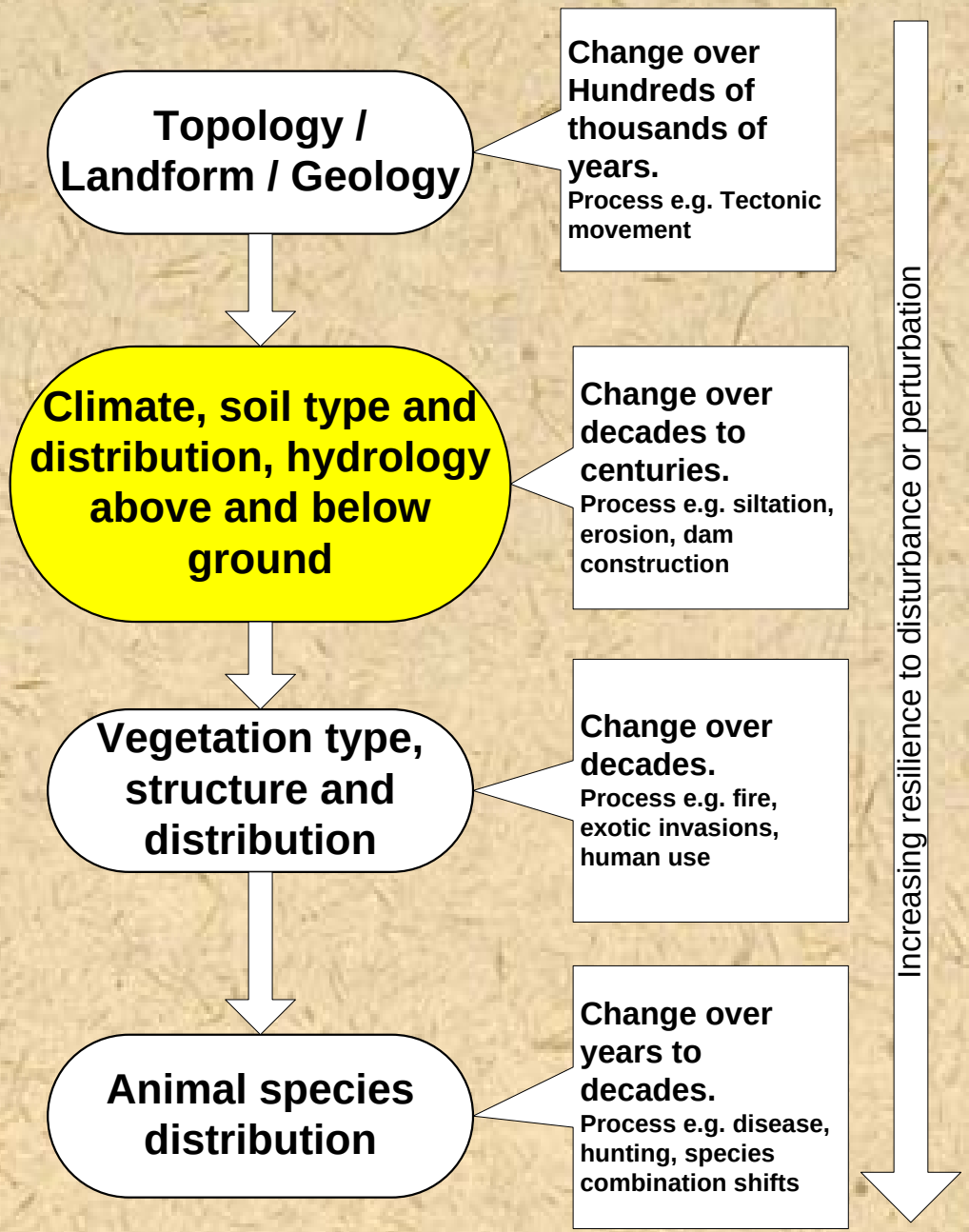
- The same structures or processes seem to be perpetuated:
  - Governance
  - Development pathways
  - Social values and norms
  - Ecosystems

System governing structures and processes

- DNA
- Administration
- Landform

System governing structures and processes

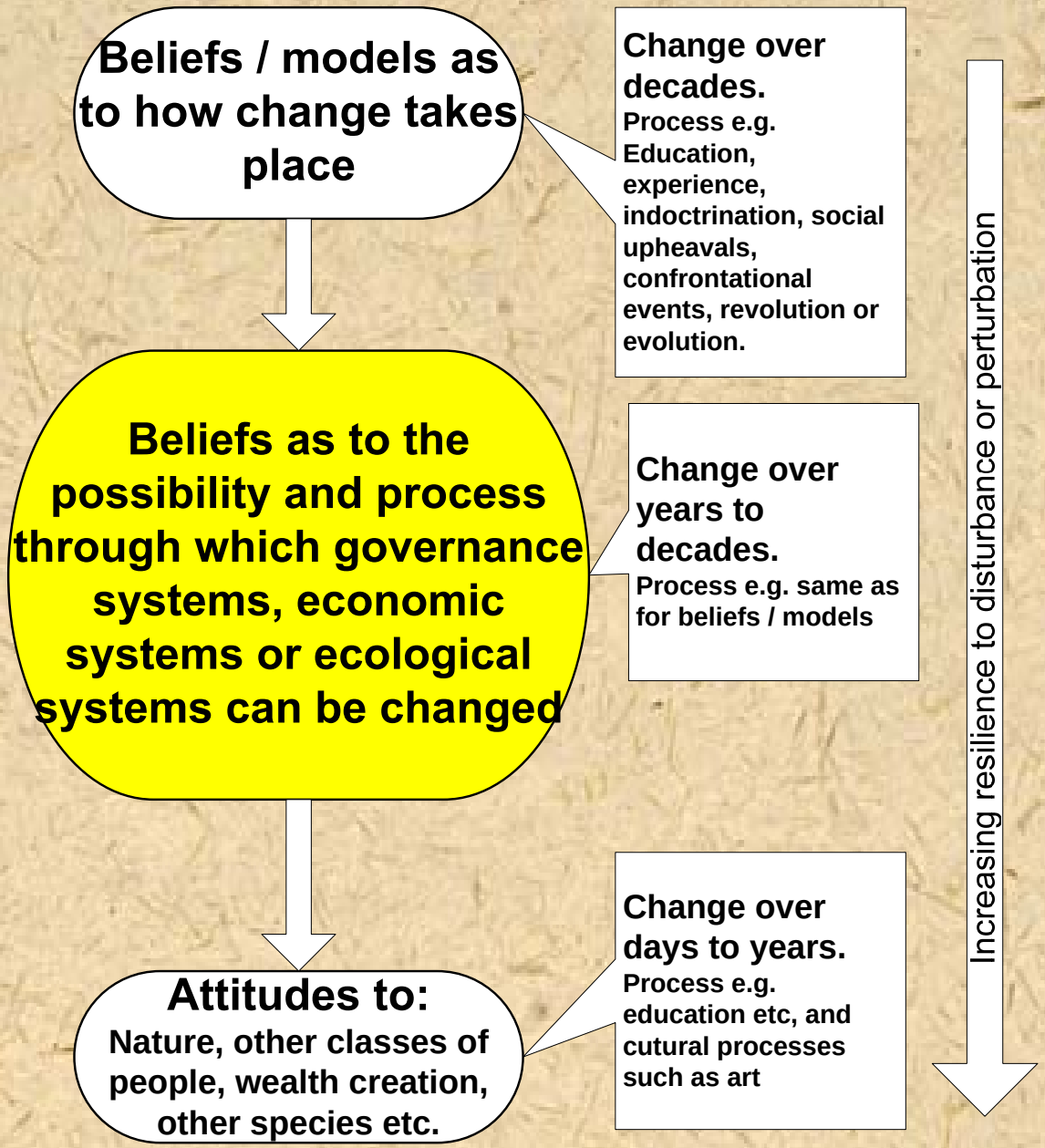
- Bio-geo-physical
- Human belief and conceptual
- Human allocative – economic and political



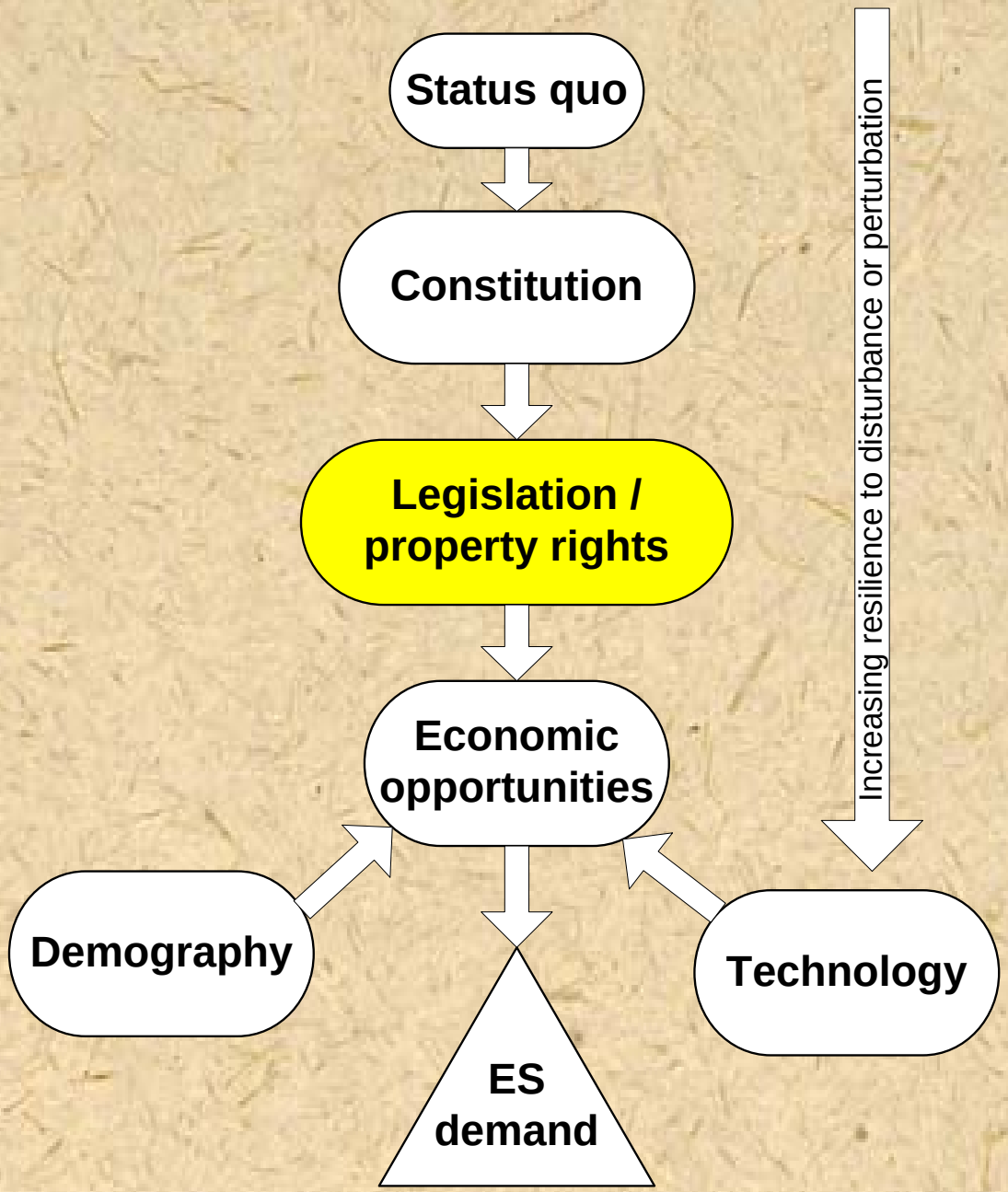
They are scaled

Bio-geo-physical

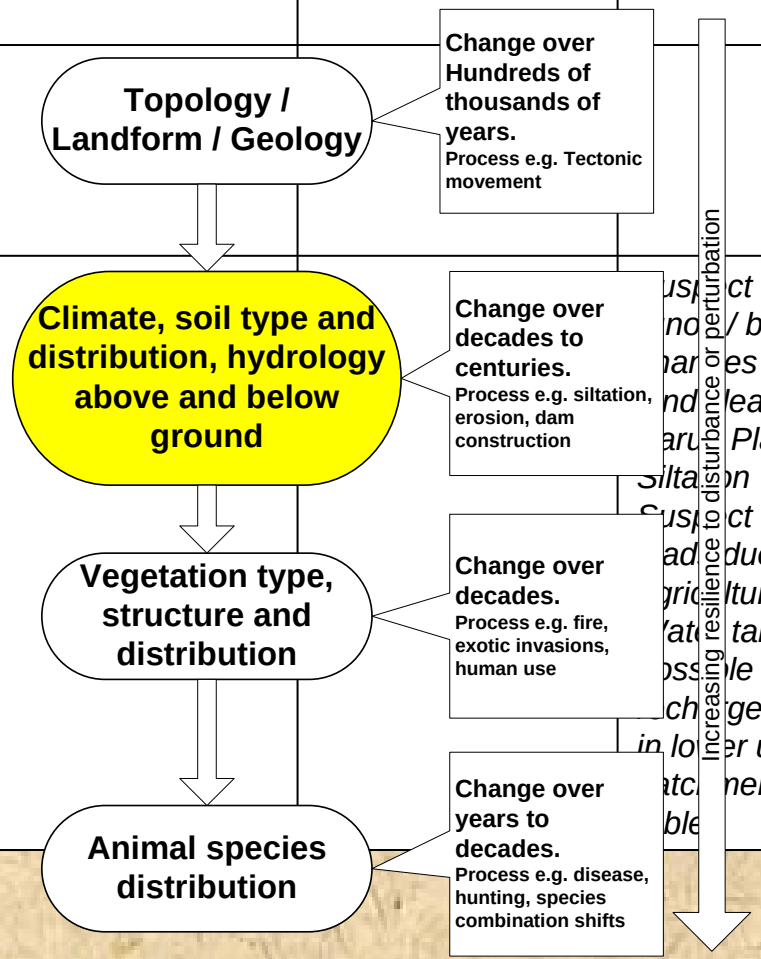
Beliefs


Beliefs / models as to how change takes place
Change over decades.
Process e.g. Education, experience, indoctrination, social upheavals, confrontational events, revolution or evolution.
Beliefs as to the possibility and process through which governance systems, economic systems or ecological systems can be changed
Change over years to decades.
Process e.g. same as for beliefs / models
Attitudes to:
Nature, other classes of people, wealth creation, other species etc.
Change over days to years.
Process e.g. education etc, and cutural processes such as art
Increasing resilience to disturbance or perturbation

Allocative


Status quo
Constitution
Legislation / property rights
Economic opportunities
Demography
ES demand
Technology
Increasing resilience to disturbance or perturbation

Bio-geophysical	***Historical time period***				
	Pre-modern human interventions	***Colonial (1950 – 1975)***	***Socialism (1975 – 1982)***	***Civil War (1982 – 1992)***	***Capitalism (1992 – present)***
Topology / landform / geology	*Growth of alluvial fans into rift floor* *Fine siltation in lower reaches e.g. Lake Urema*				
Climate, soil type and distribution, water, hydrology		*Impoundment of Zambezi drainages (Kariba, Cabora Bassa)* *Railway dyke reduces flows to Marromeu Reserve*			*ct recent* */ basal flow* *es due to* *learance on* *Plateau* *ct higher silt* *due to* *lture* *table –* *le lower GW* *ge resulting* *er upper* *ment water*



Models of how the world works	***Historical time period***				
	Tribal (pre 1950)	***Colonial (1950 – 1975)***	***Socialism (1975 – 1982)***	***Civil War (1982 – 1992)***	***Capitalism (1992 – present)***
Governance systems	*Inherited authority* *Ancestral coupling*	*Colonialist and local people split* *Colonialists dominate and "should govern" - paternalistic* *People – powerless and fearful. Still local traditional control but broader powerlessness. Subversion of traditional structures by colonial state.*	*Centralised control and planning* *Party elite in control* *Politicisation of masses* *Learning governance by doing – Machel "Learn to govern by governing"*	*Ideological split between democrats and socialists* *Exacerbated by commodity shortages* *War the only means of change* *Centralisation*	*African democracy* *Decentralisation*

Summary

- For fundamental change to occur the system governing structures or processes need to be altered.

- There appear to be at least three sets of governing structures and processes – bio-geo-physical, human belief and human allocative

Summary

- Whilst the analysis needs to be conducted at a focal scale other key scales must be considered.

- The governing structures and processes around human beliefs may be the most amenable to the influence of science.