

Extinction risk assessments at the species level: Red list status of endemic wild cinnamon species in Sri Lanka

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Introduction

- There are nine cinnamon species found in Sri Lanka.

Cinnamomum capparucoronde Blume

Cinnamomum citriodorum Thw.

Cinnamomum dubium Nees

Cinnamomum litseaefolium Thw.

Cinnamomum ovalifolium Weight

Cinnamomum rivulorum Kosterm

Cinnamomum sinharajaense Kosterm

Cinnamomum verum J. Presl

Cinnamomum camphora (L) Presl

Endemic

Indigenous type

Introduced type



Objectives

- To determine the global and national red list status of the seven endemic wild cinnamon species found in Sri Lanka and
- To assess the extinction risk of them.



Methodology

➤ An eco-geographic survey was carried out.

1. Literature survey

2. Development of potential distribution maps

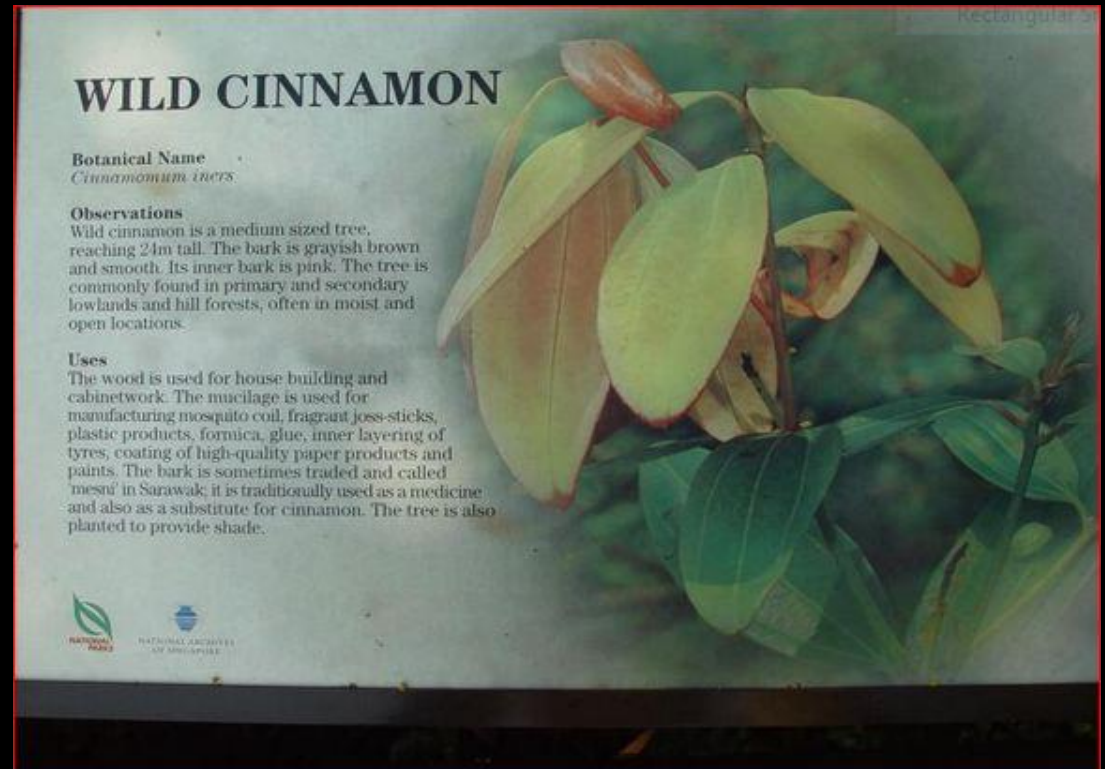
3. Field visits and data collections

4. Data analysis

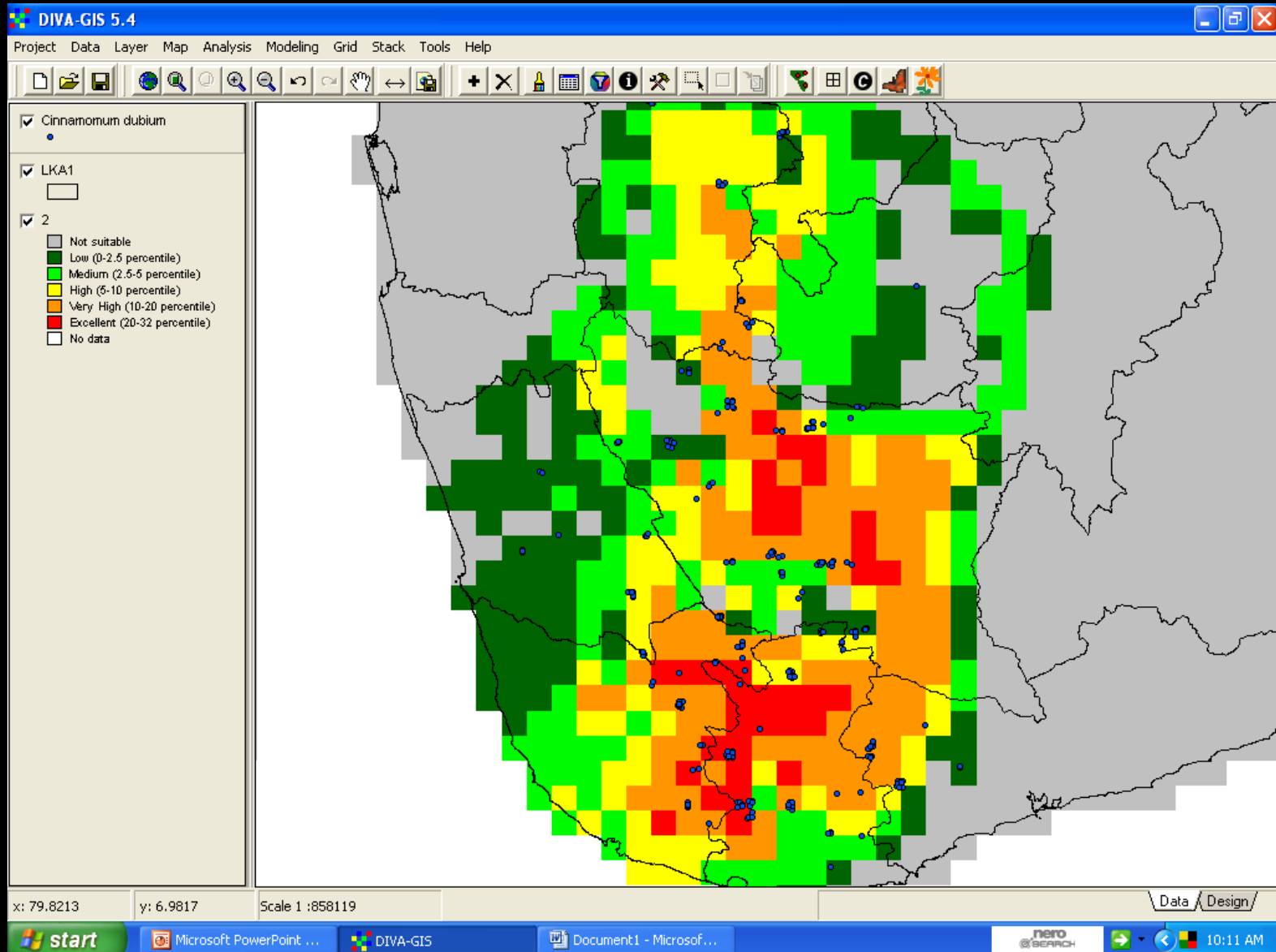
5. Application of global and national red list criteria

1. Literature survey

- Previously recorded location and time period
- Morphological characters (Identification keys and herbarium specimens)
- GPS reading and habitat type of recorded locations



2. Develop potential distribution maps (using available data in Diva-GIS)



3. Field visits and data collections

The visits were made to previously recorded locations and highly potential areas



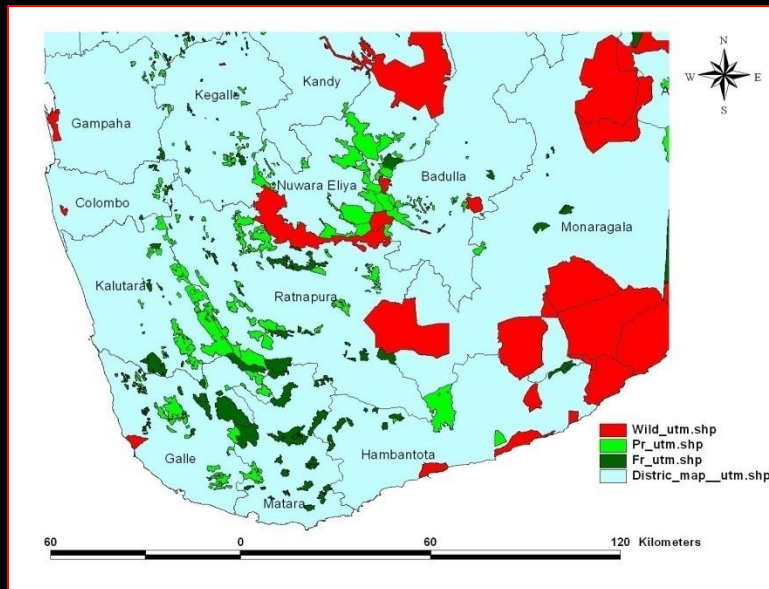
Observations made during field visits

- Longitude, Latitude and Altitude (using GPS)
- Morphology of plants
- Soil and ecological conditions
- Ethno-botanical observations (uses and main threats)



4. Data analysis

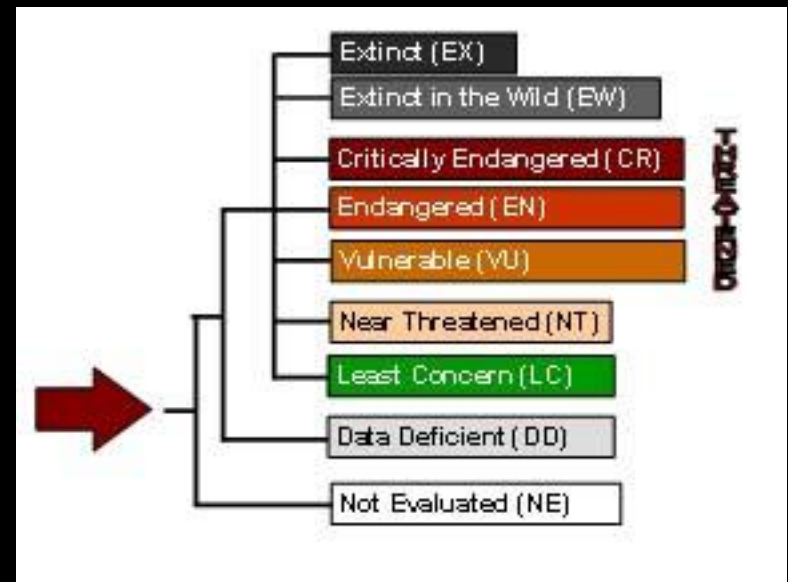
- **Distribution (using ArcView GIS 3.3 software)**
 - Extent of Occurrence and
 - Area of Occupancy)
- **Number of forest fragments (using Sri Lanka Forest cover map, protected area digital images and Google Earth satellites images)**



5. Application of global red list criteria

Global red list criteria B version 7 (August 2008) were used.

This includes restricted geographic range and fragmentation, continuing decline or extreme fluctuations.

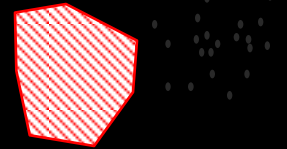


Criteria B

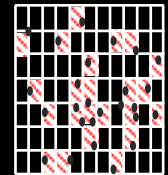
Restricted geographic range and fragmentation,
continuing decline or extreme fluctuations

Based on either of two sub-criteria:

B1: Estimated extent of occurrence (EOO)

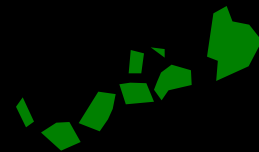


B2: Estimated area of occupancy (AOO)



AND at least **TWO** of a-c:

a. Severely fragmented or few locations



b. Continuing decline



c. Extreme fluctuations



5. Application of national red list criteria

- Data were analyzed by using IUCN national red listing criteria (2008)

Cut off points of national red listing criteria

Category	Highly Threatened	Threatened	Indeterminate	Not Threatened
Avg. Score	≥ 4	3.9 – 3	2.9 – 2	1.9 - 0
Short form	HT	T	I	NT

CRITERIA	Score of 5	Score of 4	Score of 3	Score of 2	Score of 1	Score of 0
Extent of geographical range and rarity (Km²)	Very rare; found in one zone	Very rare; found in more than one zone	Rare; found in one zone	Rare; found in more than one zone	Common, but found in one zone	Common and found in more than one zone
Area of Occupancy (Km²)	≤ 8	09 -20	21 - 40	41 - 120	121 - 200	> 200
Restricted populations	Very restricted	-	-	-	-	-
Habitat status (per cent of habitat under protection)	0 – 25 %	26 - 40 %	41 – 55 %	56 - 65 %	66 - 75 %	> 75%
Intrinsic characters	≥ 10+	9+ to 8+	7+ to 6+	5+ to 4+	3+	≤ 2
Human impact on the habitat	≥ 8+	7+ to 6+	5+ to 4+	3+ to 2+	1+	Recorded as no impact
Recorded human impact on the species	10 points	9 points	8 to 7 points	6 to 5 points	4 to 3 points	2 points
Endemism/ global threat status	Endemic		Globally threatened			Others

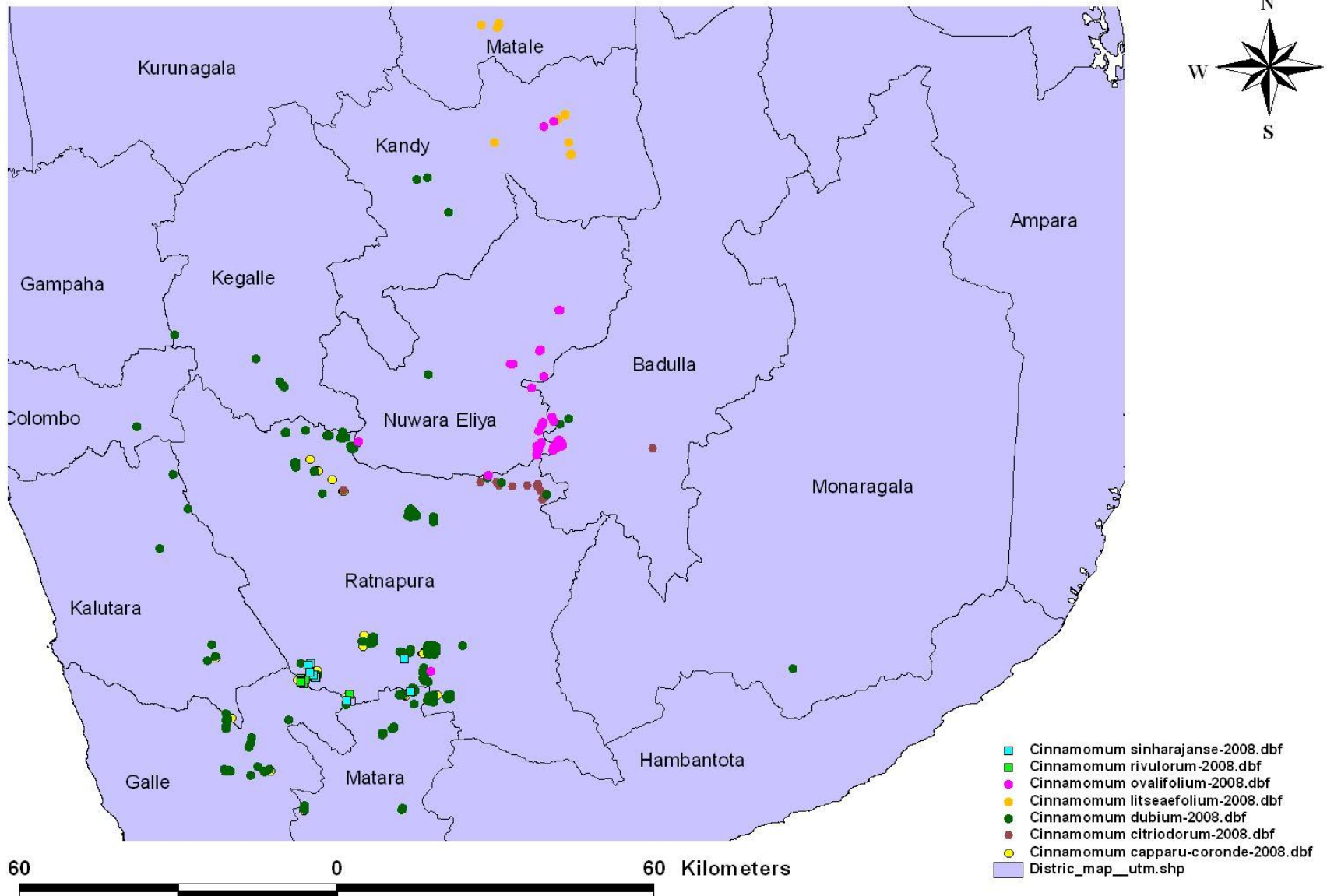


Results

Distribution of wild cinnamon species

Species name	Distributed districts /Locations
<i>Cinnamomum dubium</i>	Galle, Matara, Kalutara, Rathnapura, Kegalle, Colombo, Gampha, Badulla and Kandy
<i>Cinnamomum capparucoronde</i>	Sinharaja FR, KDN complex, Gilimale-Erathne PR, Gongala PR, Enasalwatte PR, Walankanda FR, Kalugala PR and Haycoaks FR
<i>Cinnamomum ovalifolium</i>	Kandaploa Sita Eliya PR, Haggala S.N.R., Horton plain, Sri pada sanctuary, Kikiliyamana PR and Mahakudugala PR
<i>Cinnamomum litseaefolium</i>	Knuckles Conservation area
<i>Cinnamomum sinharajense</i>	Sinharaja FR
<i>Cinnamomum rivulorum</i>	Sinharaja FR
<i>Cinnamomum citriodorum</i>	Hape, Norwood and Haputale region

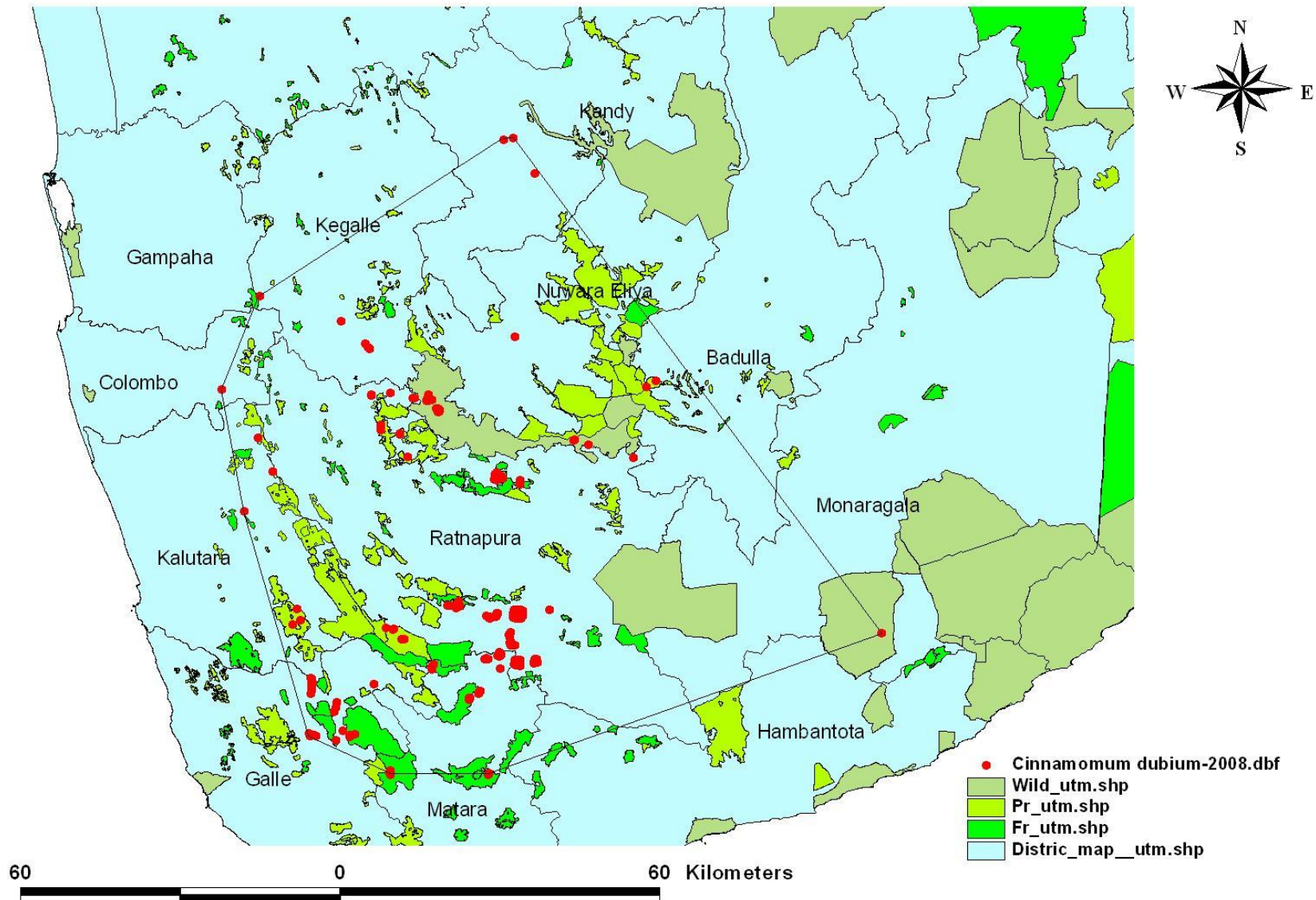
Wild cinnamon distribution map



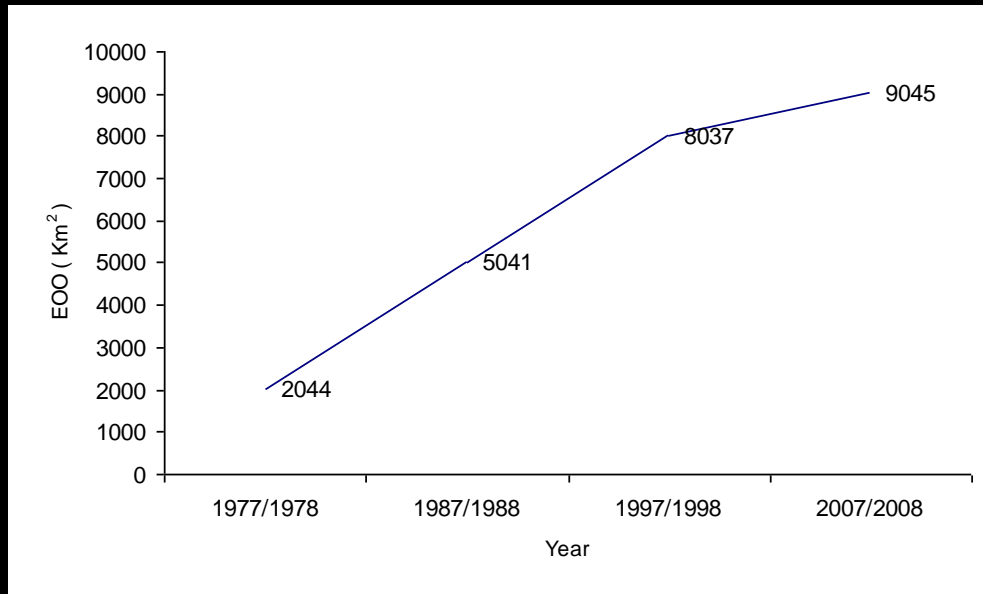
Cinnamomum dubium



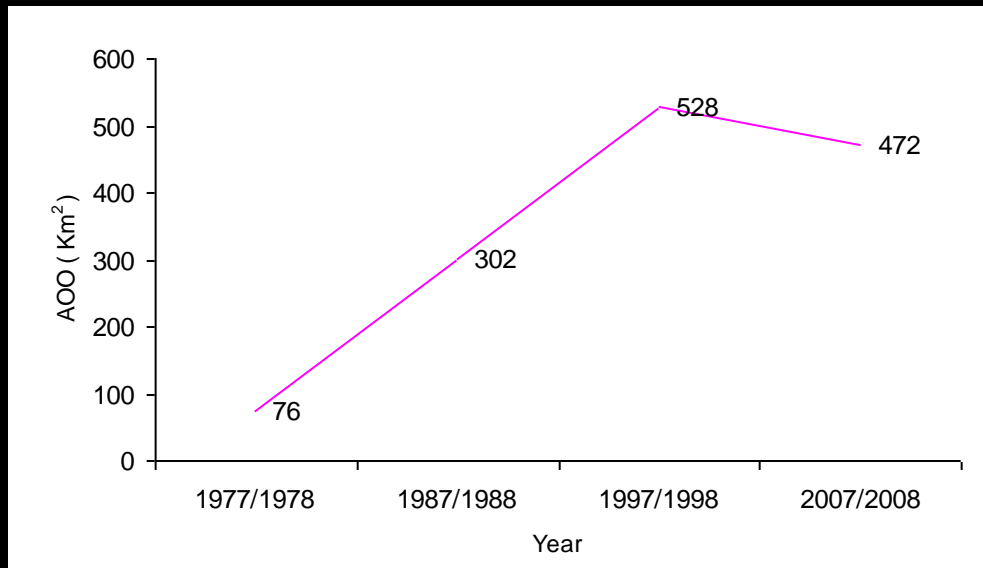
Extent of Occurrence (EOO) and Area of Occupancy (AOO)



1. Variation of EOO value



2. Extreme fluctuation of AOO

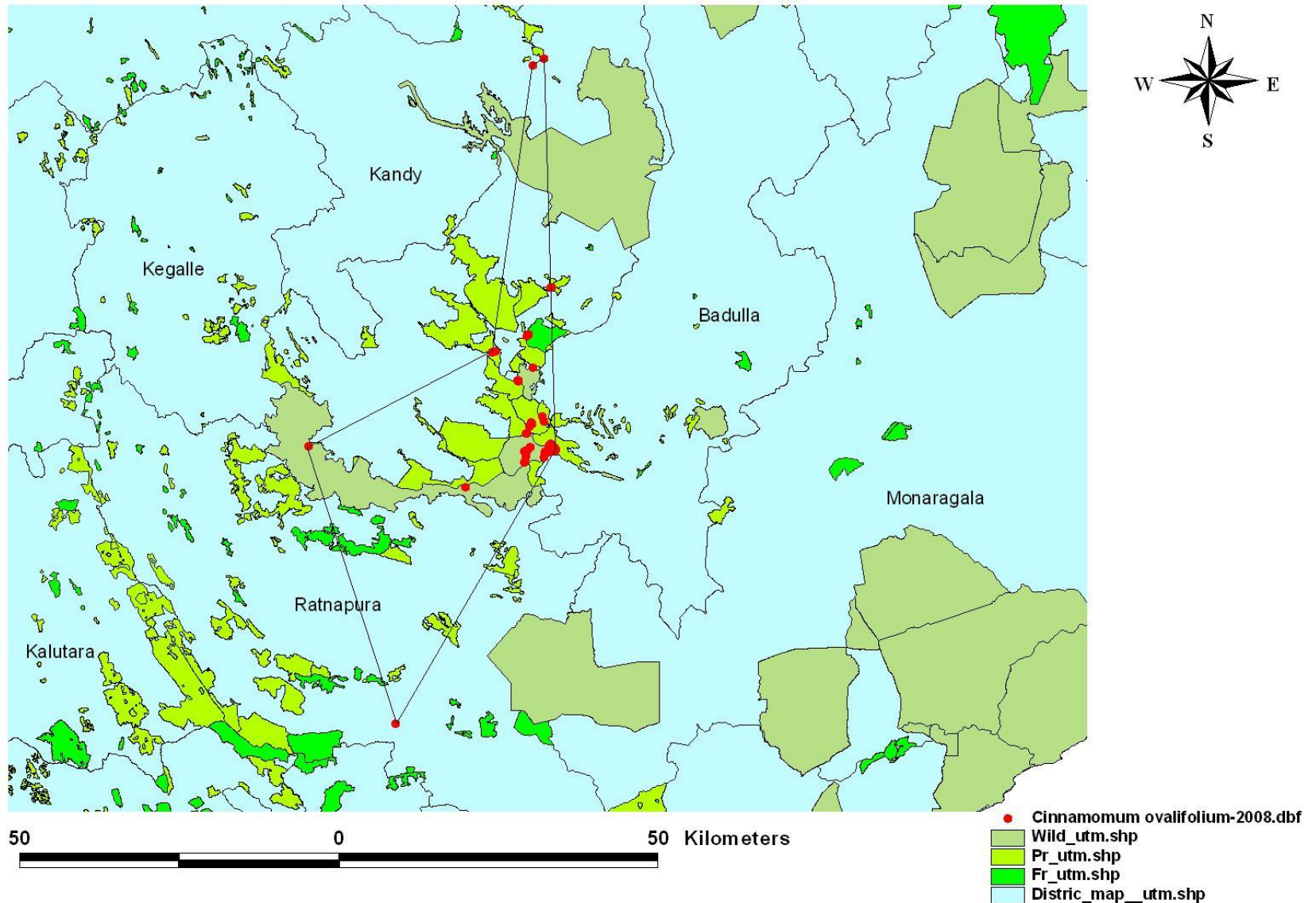


- **Number of forest fragments are more than twenty**
- **Good survival rate in low country wet zone**
- **Elevation 90m to 2000m**
- **High adaptability to different climatic conditions**
- **No major threats to this plant**
- **Barks use to adulterate cinnamon and trunk of the tree uses as a timber**
- **Very common species**

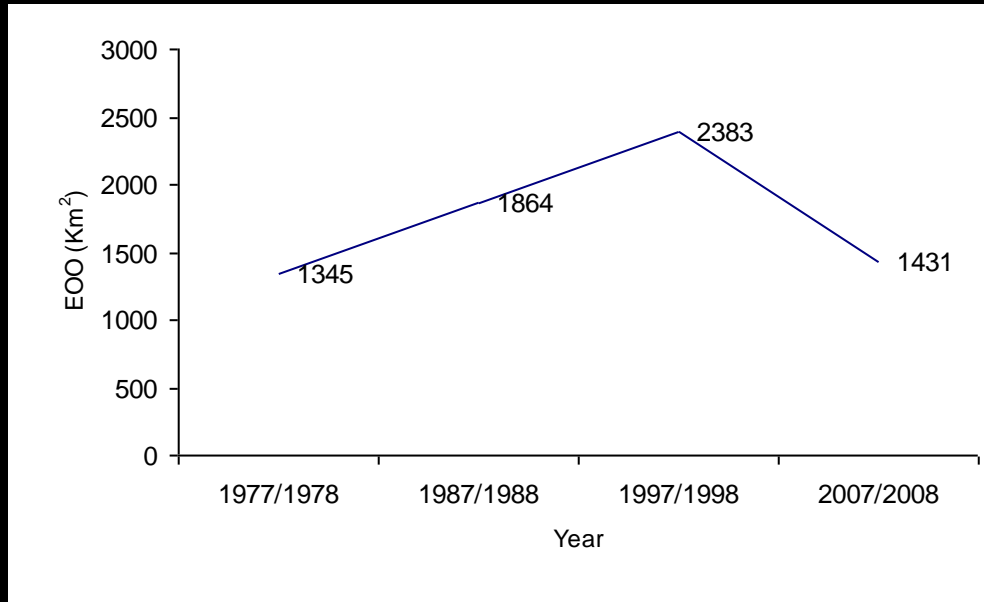
Cinnamomum ovalifolium



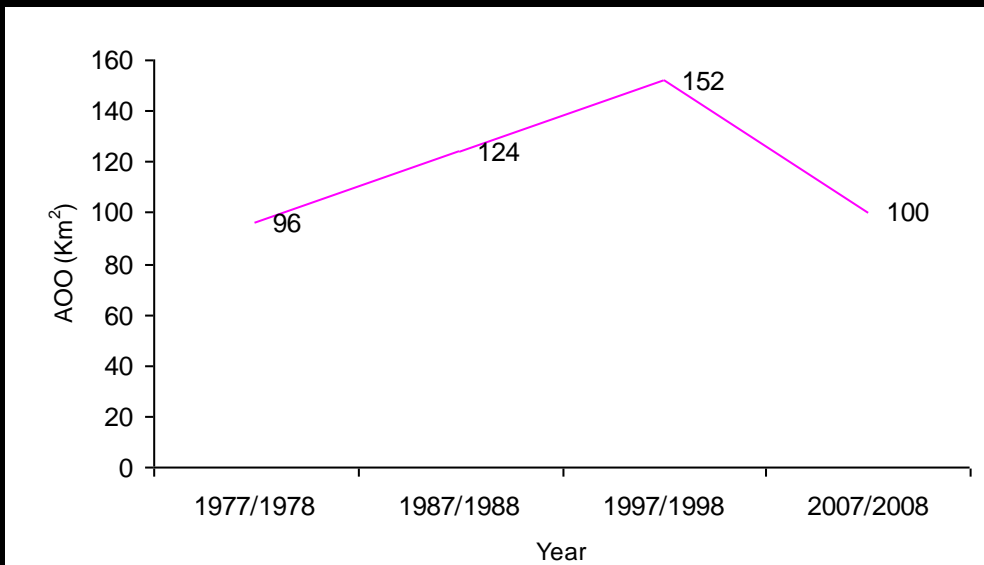
Extent of Occurrence (EOO) and Area of Occupancy (AOO)



1. Extreme fluctuation of EOO



2. Extreme fluctuation of AOO

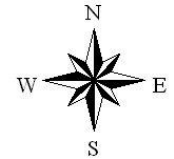
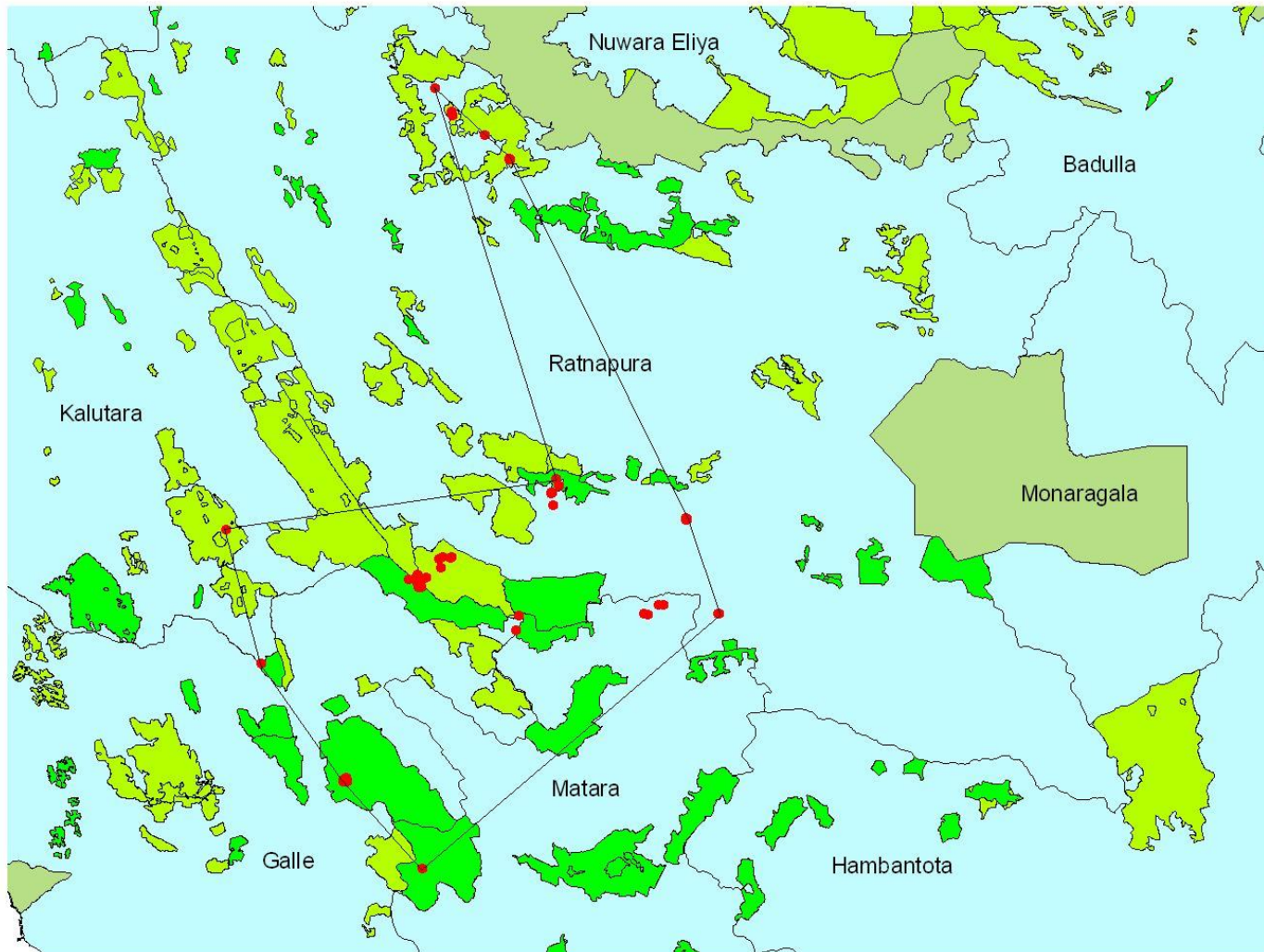


- **Number of forest fragments are limited to five**
- **Good survival rate in up country under moist weather conditions**
- **Elevation more than 1200m from MSL**
- **Primary habitat is Montane forest**
- **Not uses were reported**
- **Common species**

Cinnamomum capparucoronde



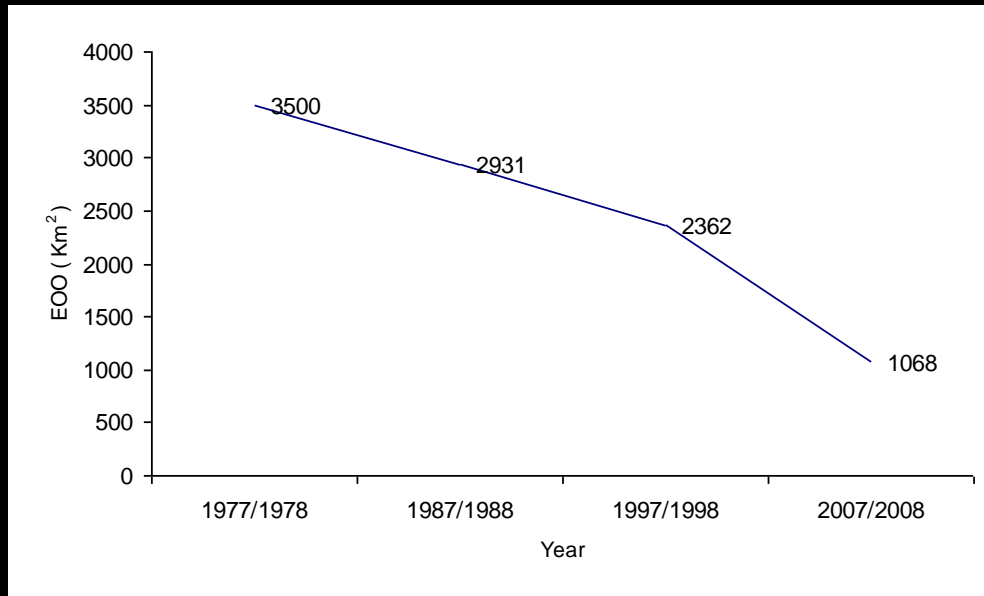
Extent of Occurrence (EOO) and Area of Occupancy (AOO)



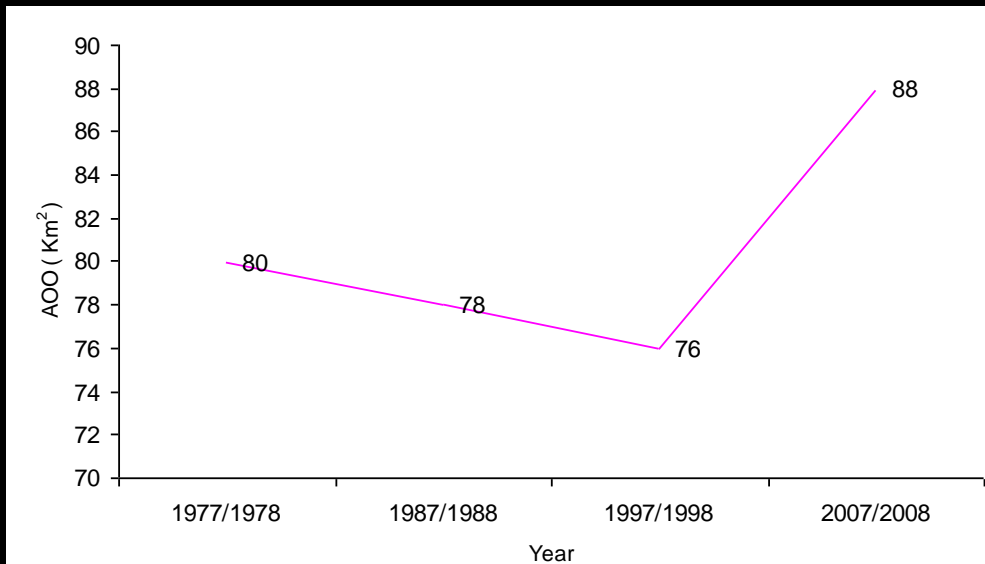
30 0 30 Kilometers

- Cinnamomum capparucoronde-2008.dbf
- Wild_utm.shp
- Pr_utm.shp
- Fr_utm.shp
- Distric_map__utm.shp

1. Continuing decline of EOO



2. Extreme fluctuation of AOO



Habitat ecology

- Number of forest fragments are six
- Primary habitat is tropical rain forest
- Annual Rain Fall is 1875 mm to above
- Topography is slope & hilly area
- Elevation 90 m to 1100m from MSL
- Rare species

Medicinal uses

- Toothache
- Bronchitis
- Rheumatism
- Snake bite
- Bone fractures

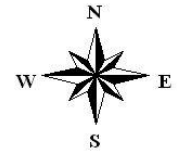
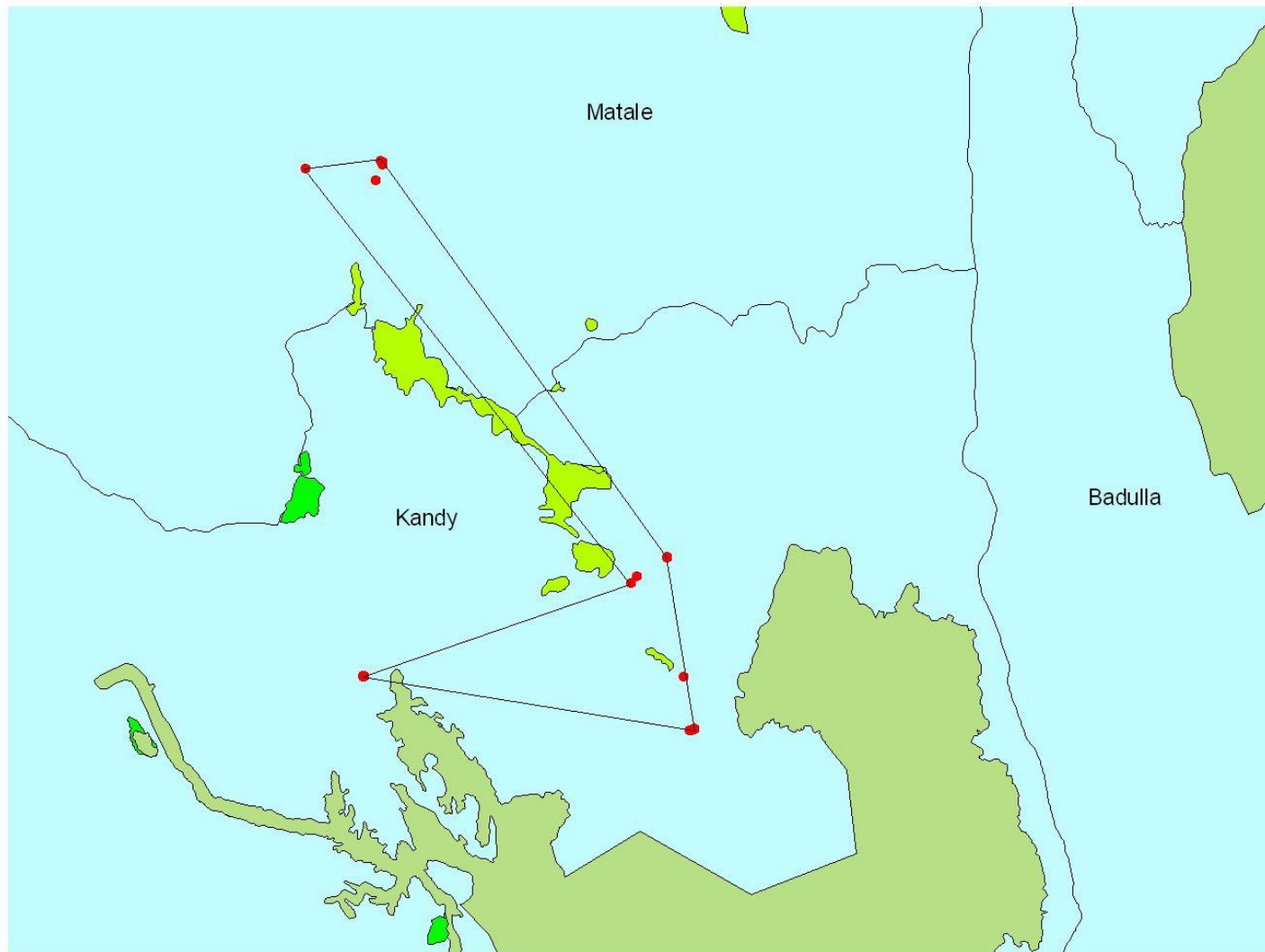
Industrial uses

- Furniture
- Local trade

Cinnamomum litseaefolium



Extent of Occurrence (EOO) and Area of Occupancy (AOO)



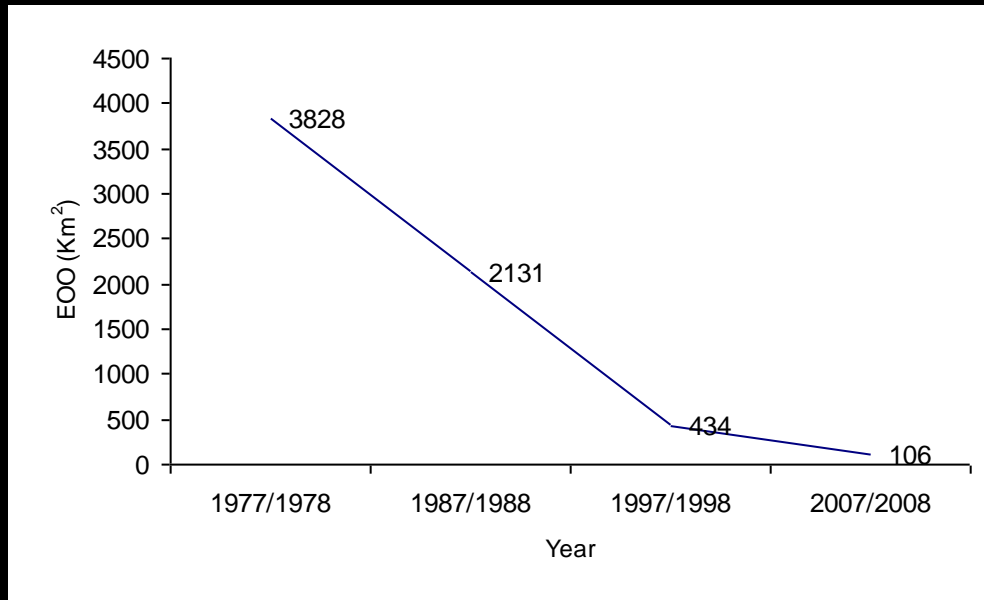
20

0

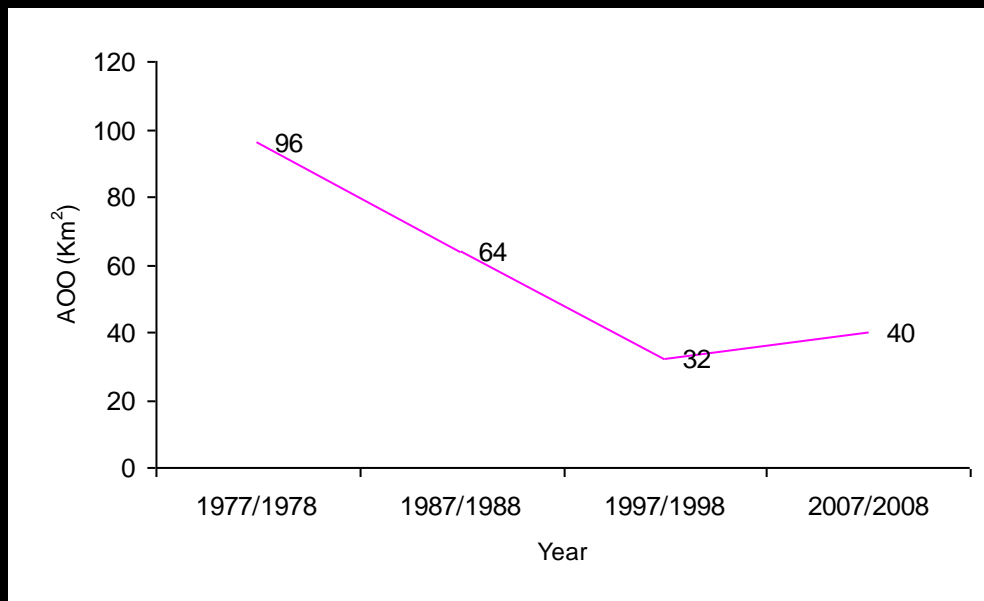
20 Kilometers

- *Cinnamomum litseaefolium-2008*.dbf
- Wild_utm.shp
- Pr_utm.shp
- Fr_utm.shp
- Distric_map_utm.shp

1. Continuing decline of EOO



2. Extreme fluctuation of AOO



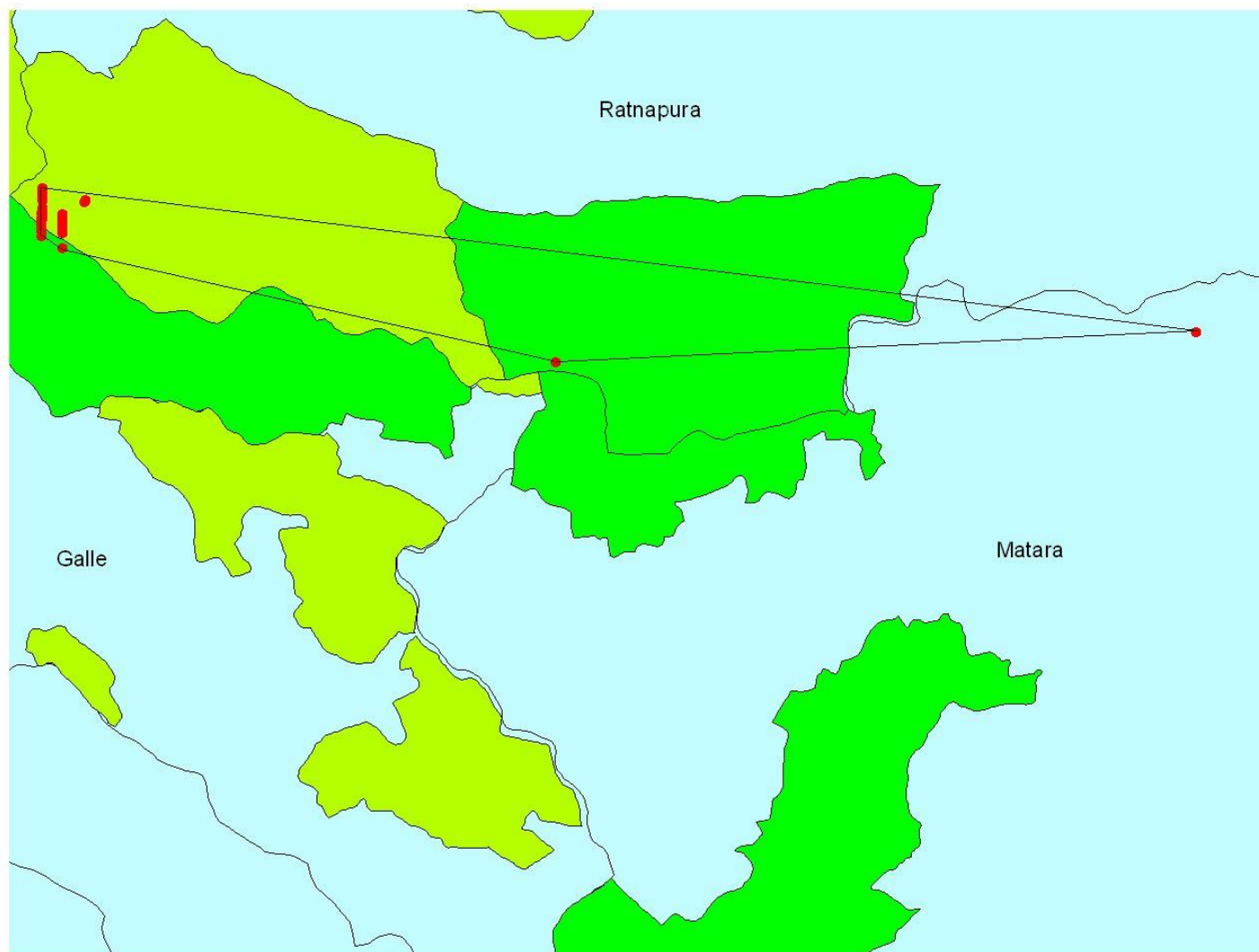
- **Number of forest fragments reported is only one.**
 - **Knuckles conservation area**
- **Primary habitat is up country dry montane forest (Pigmies forest)**
- **Good growing rate in windy and dry weather conditions of higher elevation**
- **Uses are unknown**
- **Rare species**



Cinnamomum rivulorum



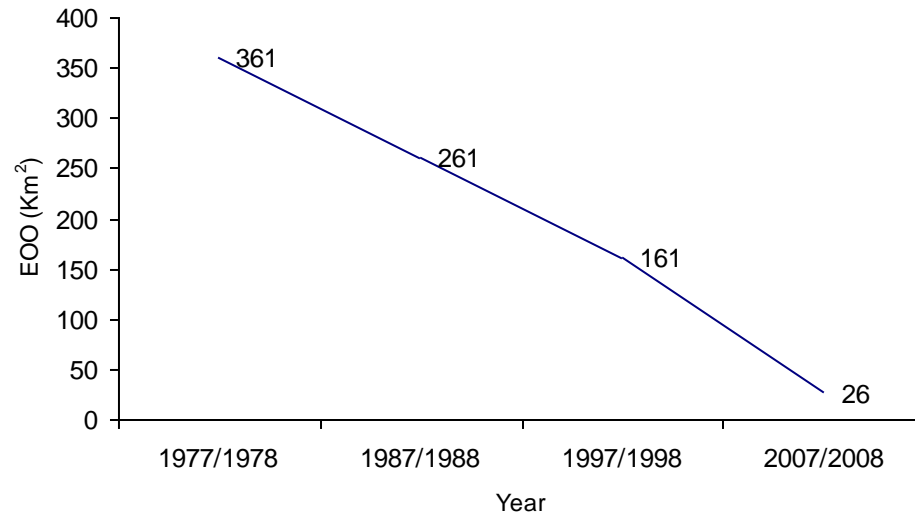
Extent of Occurrence (EOO) and Area of Occupancy (AOO)



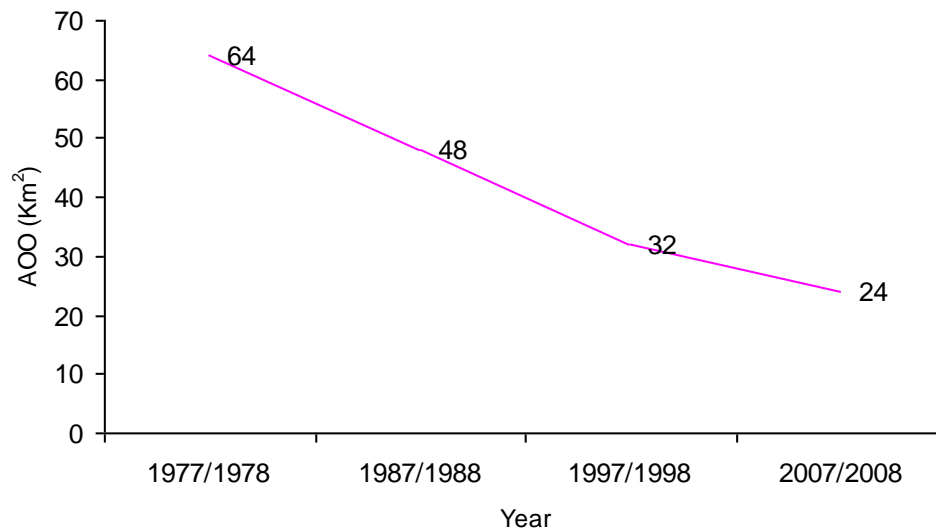
6 0 6 Kilometers

- Cinnamomum rivulorum-2008.dbf
- Wild_utm.shp
- Pr_utm.shp
- Fr_utm.shp
- Distric_map__utm.shp

1. Continuing decline of EOO



2. Continuing decline of AOO

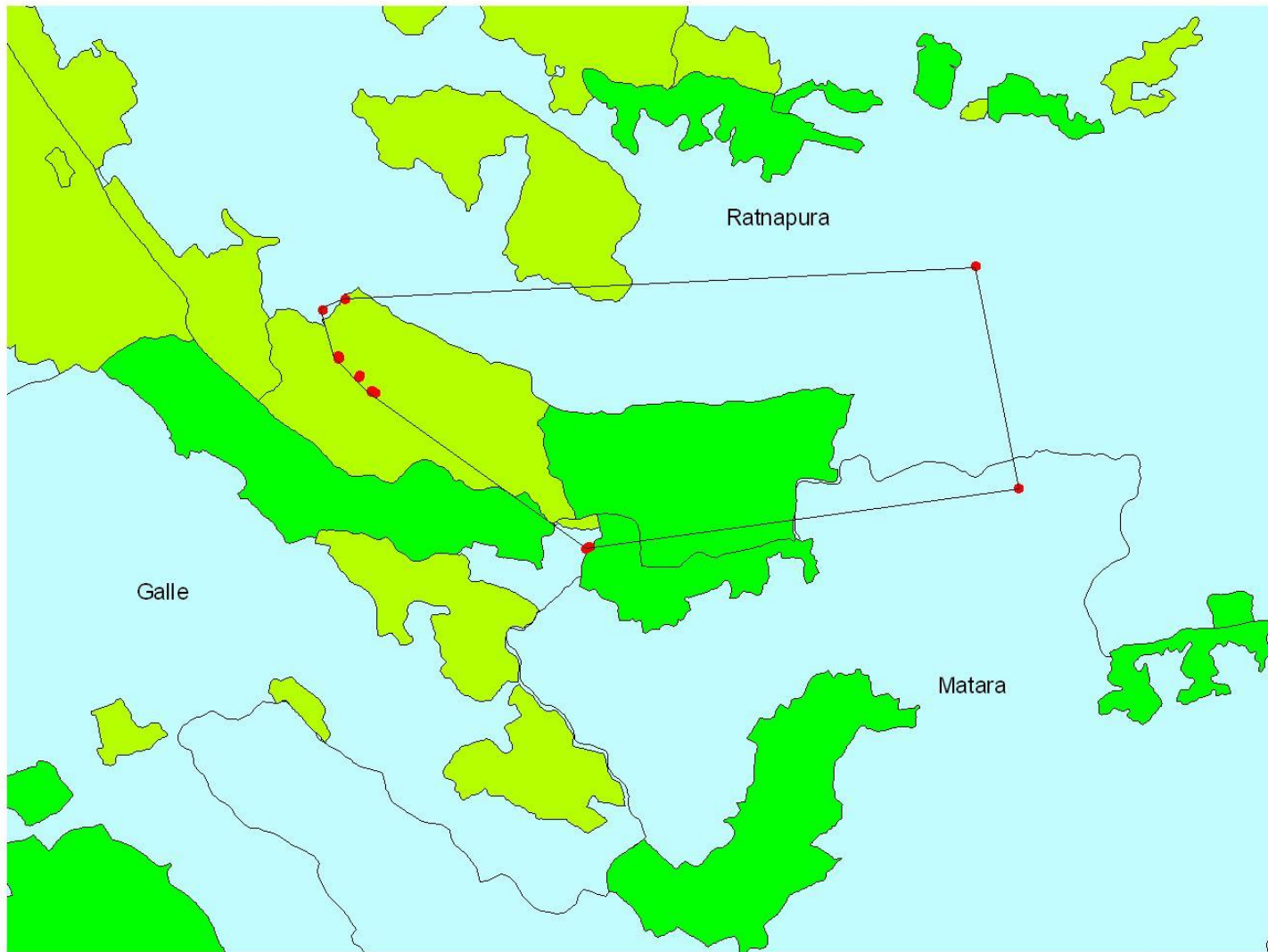


- **Number of forest fragments are only one.**
 - **Sinharaja FR & Sinharaja division-Enasalwatte**
- **Primary habitat is low country rain forest**
- **Good growing rate in moist and shade weather conditions**
- **Uses are unknown**
- **Very rare species**

Cinnamomum sinharajanse

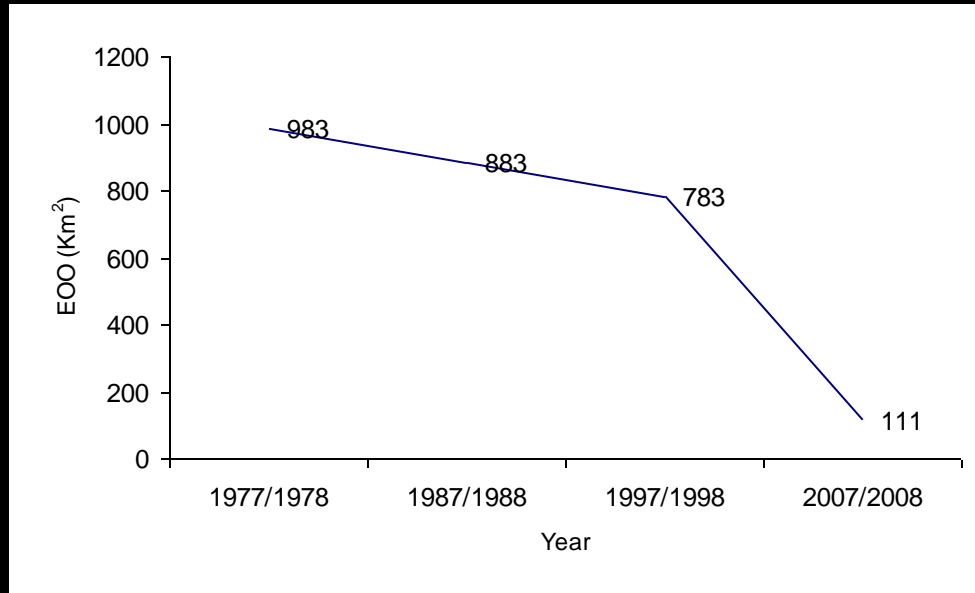


Extent of Occurrence (EEO) and Area of Occupancy (AOO)

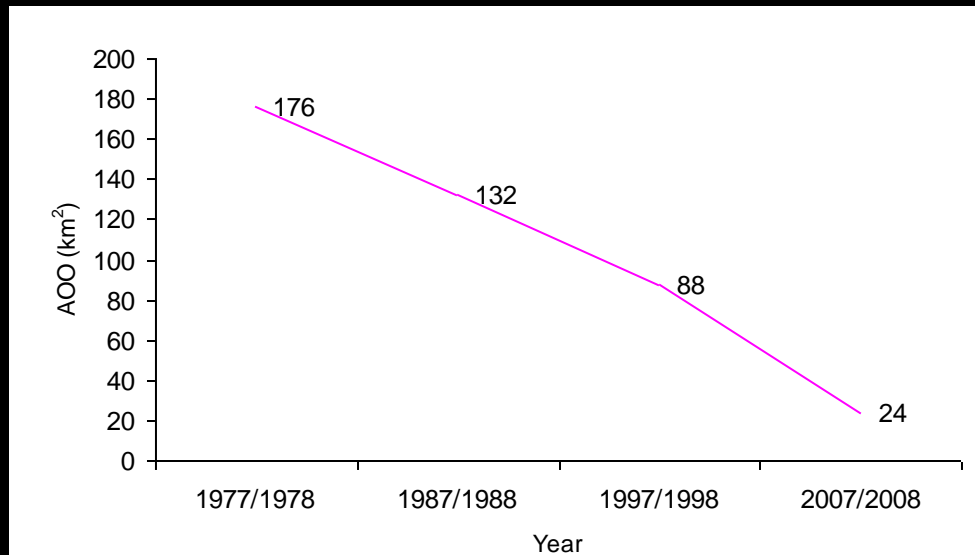


- Cinnamomum sinharajense-2008.dbf
- Wild_utm.shp
- Pr_utm.shp
- Fr_utm.shp
- Distric_map_utm.shp

1. Continuing decline of EOO



2. Continuing decline of AOO

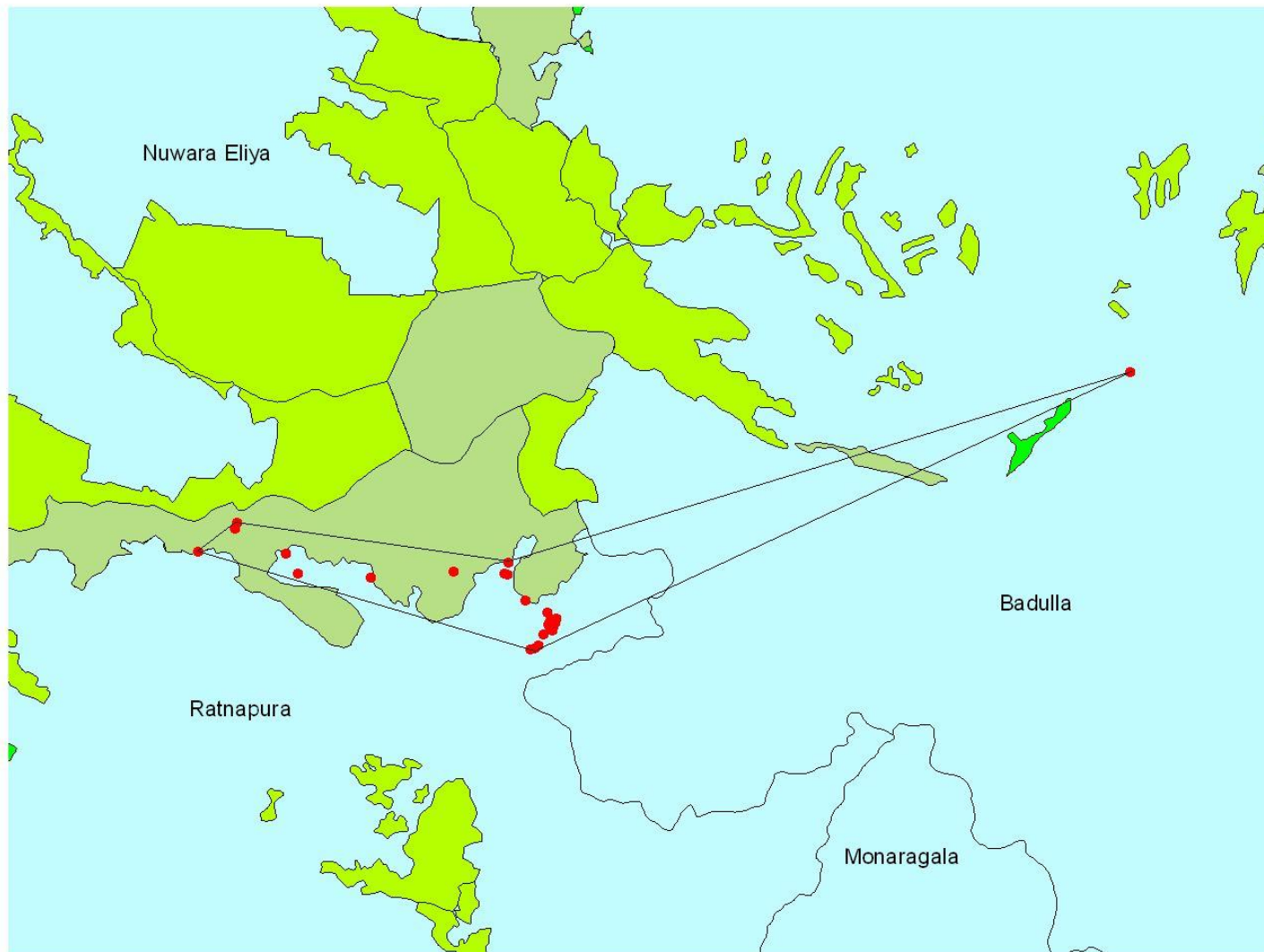


- **Number of forest fragments are only one.**
 - **Sinharaja FR & Sinharaja division-Enasalwatte**
- **Distribution in Galle, Matara and Ratnapura districts**
- **Primary habitat is low country rain forest**
- **Good growing rate in moist and shade weather conditions**
- **Uses are unknown**
- **Very rare species**

Cinnamomum citriodorum



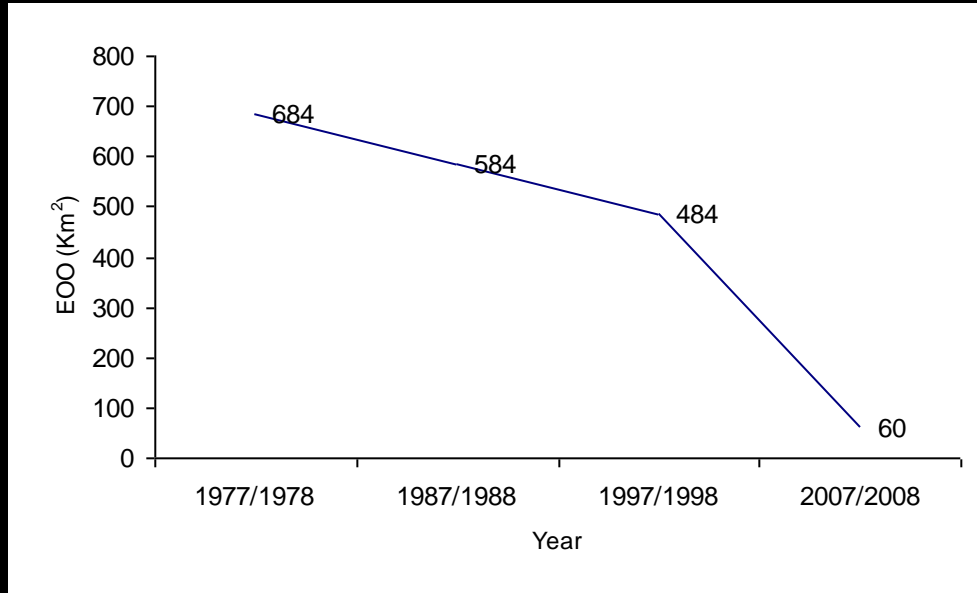
Extent of Occurrence (EOO) and Area of Occupancy (AOO)



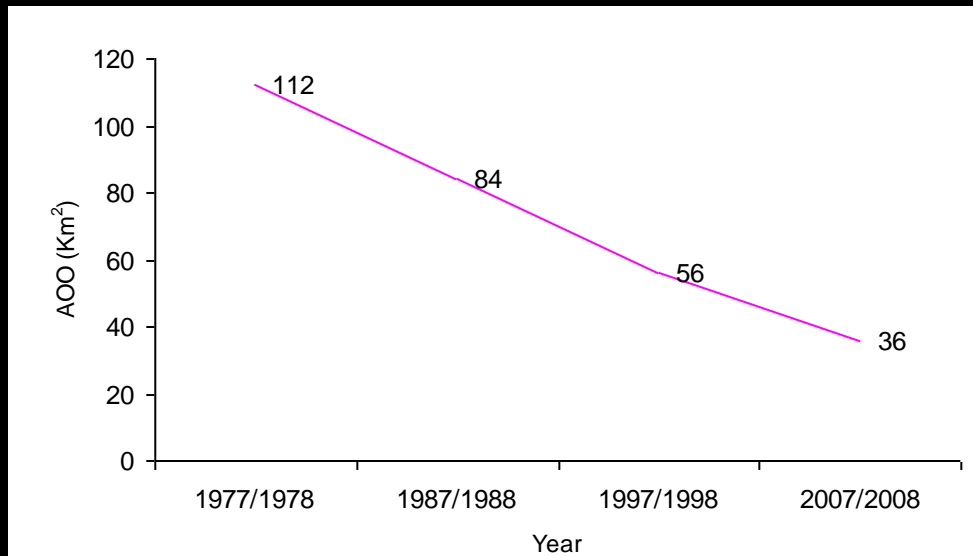
10 0 10 20 Kilometers

- Cinnamomum citriodorum-2008.dbf
- Wild_utm.shp
- Pr_utm.shp
- Fr_utm.shp
- Distric_map_utm.shp

1. Continuing decline of EOO



2. Continuing decline of AOO



- **Number of forest fragments are one;**
 - **Norwood – Halpe – Balangoda region**
- **Distribution in Ratnapura, Badulla and Monaragala districts**
- **Primary habitat is tropical semi-dry forest**
- **use in local medicine**
- **Rare species**

Global red list status of wild cinnamon

Species name	EOO (Km ²)	AOO (Km ²)	Number of forest fragments	** Continuing decline of		** Extreme fluctuation of	
				EOO	AOO	EOO	AOO
<i>Cinnamomum dubium</i>	9045	472	>20				Yes
<i>Cinnamomum capparucoronde</i>	1068	88	6	Yes			Yes
<i>Cinnamomum ovalifolium</i>	1431	100	5			Yes	Yes
<i>Cinnamomum litseaefolium</i>	106	40	1	Yes			Yes
<i>Cinnamomum sinharajanse</i>	111	24	1	Yes	Yes		
<i>Cinnamomum rivulorum</i>	26	24	1	Yes	Yes		
<i>Cinnamomum citriodorum</i>	60	36	1	Yes	Yes		

** EOO and AOO value analyzed by within last 30 years

National Red List Assessment: Average scoring values of each species

Species name	Average scoring value
<i>Cinnamomum dubium</i>	1.375
<i>Cinnamomum ovalifolium</i>	2.25
<i>Cinnamomum litseaefolium</i>	3.125
<i>Cinnamomum rivulorum</i>	3.5
<i>Cinnamomum sinharajanse</i>	3.625
<i>Cinnamomum capparucoronae</i>	4
<i>Cinnamomum citriodorum</i>	4.5

Cut off point table

Category	Highly Threatened	Threatened	Indeterminate	Not Threatened
Avg. Score	≥ 4	3.9 – 3	2.9 – 2	1.9 - 0
Short form	HT	T	I	NT

Threats to wild *Cinnamomum* species

- Natural disasters such as Landslides
- Human activities such as
 - Over exploitation
 - Urbanization
 - Poor agricultural practices
- Habitat destruction
- Forest burning
- Lack of awareness peoples
- Illegal practices



Conclusion

Species Name	Global Red List Criteria
<i>Cinnamomum dubium</i>	Least Concern (LC)
<i>Cinnamomum ovalifolium</i>	Endangered (EN)
<i>Cinnamomum capparucoronae</i>	Endangered (EN)
<i>Cinnamomum litseaefolium</i>	Critically Endangered (CR)
<i>Cinnamomum rivulorum</i>	Critically Endangered (CR)
<i>Cinnamomum sinharajense</i>	Critically Endangered (CR)
<i>Cinnamomum citriodorum</i>	Critically Endangered (CR)

Species Name	National Red List Criteria
<i>Cinnamomum dubium</i>	Not threatened (NT)
<i>Cinnamomum ovalifolium</i>	Intermediate (I)
<i>Cinnamomum capparucoronde</i>	Highly threatened (HT)
<i>Cinnamomum litseaefolium</i>	Threatened (T)
<i>Cinnamomum rivulorum</i>	Threatened (T)
<i>Cinnamomum sinharajanse</i>	Threatened (T)
<i>Cinnamomum citriodorum</i>	Highly threatened (HT)

Species Name	Global Red List Criteria	National Red List Criteria
<i>Cinnamomum capparucoronde</i>	Endangered (EN)	Highly Threatened (HT)
<i>Cinnamomum dubium</i>	Least Concern (LC)	Not Threatened (NT)
<i>Cinnamomum ovalifolium</i>	Vulnerable (VU)	Indeterminate (I)
<i>Cinnamomum litseaefolium</i>	Critically Endangered (CR)	Threatened (T)
<i>Cinnamomum rivulorum</i>	Critically Endangered (CR)	Threatened (T) *
<i>Cinnamomum sinharajense</i>	Critically Endangered (CR)	Threatened (T) *
<i>Cinnamomum citriodorum</i>	Critically Endangered (CR)	Highly Threatened (HT) *

- HT * - Highly threatened and immediately come to extinct level
T * - Threatened and immediately come to highly threatened level
I - Indeterminate. But not threatened

Cinnamomum citriodorum and *Cinnamomum capparucoronde* are highly risk at national level. Conservation practices are compulsory.

■ During this study following locations were identified as areas with high extinction risks

- Sinharaja division & Ihalakurulugala PR- Enasalwatte-Deniyaya
- Gongala PR
- Wavul Iena Kanda- Near Haycock
- Knuckles conservation area & surrounding area
- Great Western PR
- Namunukula PR
- Donawa Mukala-Rathganga-Ratnapura districts
- Gilimale-Erathne PR
- Idigastanne Kale-Halpe

Illegal practices



Reforestation



Landslips



Poor agriculture practices



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