# Short-term dynamics of a subtropical monsoon forest in southern Taiwan

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# An Island of Typhoon



#### 450 events of typhoon for the last 100 yeas

## North-easterly monsoon

The north-easterly monsoon winds are particularly strong and persistent in the southern tip of Taiwan because of a topographic funneling effect.

This region is located at the first break in the central mountain massif that runs the length of Taiwan.

Wind speed increases 3- to 4fold during the monsoon season. Incident radiation, however, decreases 3- to 4-fold during the monsoon season.





## Nanjenshan Forest Dynamics Plot

- A 3-ha FDP measuring 300m E-W and 100m N-S was established in 1990.
- All woody plants with a stem diameter of 1 cm or larger are measured, tagged, mapped and identified.
- The second census was completed in 1997, and the third census was completed in 2005.
- Rainfall: ~ 2600mm
- Temp: 20.4°C (January) to 28.5°C (July)

# Nanjenshan FDP

- The number of species increased from 118 species in 1990 to 123 species in 2005.
- Total abundance decreased from 36571 in 1990 to 31689 in 2005.
- Species abundance ranges from a single individual to several thousand individuals.



## Species abundance curve



## TWINSPAN overlay with topography



## **Distribution** pattern





- Does wind stress affect mortality pattern and recruitment pattern?
- Is mortality/recruitment rate density dependent?
- Do common species become more abundant and rare species become rarer?
- What factors are responsible for the observed patterns?
- Can species replace themselves when an individual died?

## Mortality (recruitment) hotspot?

#### Model II regression



#### Annual mortality rate in each quadrat



#### Annual recruitment rate in each quadrat





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## Mortality and Recruitment vs. Abundance in 10x10m quadrat

#### Model II regression





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#### Mortality and Recruitment vs. Species abundance

Model II regression



#### Change in abundance between 1990-2005





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## SAR model

- Quadrat based simultaneous autoregressive model (SAR) that taken into account topographic factors indicated that only elevation significantly affected the observed mortality/recruitment pattern.
- Mortality ~ elevation + slope + convexity + aspect

	Elevation	Convexity	Slope	Sin(aspect)	Cos(aspect)
Mortality 9097	-, p=0.008	n.s.	-, p=0.07	n.s.	n.s.
Mortality 9705	-, p=0.013	n.s.	n.s.	n.s.	n.s.
Recruitment 9097	-, p=0.002	n.s.	n.s.	n.s.	n.s.
Recruitment 9705	-, p<0.0001	n.s.	n.s.	n.s.	n.s.



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## Self replacement potential



- Individual alive in 1990 and died in 1997
- Conspecific new recruit occurred within 5 meter radius in 1997 and survived till 2005
- Only species with more than
  5 dead individuals were included in the analysis

## Self replacement potential



## Conclusion

- There is significant correlation between quadrat mortality/recruitment rate in the two recensus, suggested mortality/recruitment hotspot maybe existed in the plot.
- Annual mortality is not density-dependent, however, recruitment rate is significantly affected by density in 10x10 quadrat.
- Species abundance has no significant effect on annual mortality or recruitment rate.
- Based on SAR model, only elevation has significantly effected on the observed mortality/recruitment pattern.
- Self replacement potential is low for most species, but increased as species abundance increased.

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