

WK IV LANDSCAPE STRUCTURE: PATCHES

Referensi:
Dramstad, Olson & Forman (1996) dan Farina (1998)

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 **PENGANTAR EKOLOGI LANSKAP (ARL 230)**
DEPARTEMEN ARSITEKTUR LANSKAP
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JADWAL KULIAH PENGANTAR EKOLOGI LANSKAP

Week	Date	Topic	PIC
I	8 Feb 2018	Introduction to Landscape Ecology	HSA
II	15 Feb 2018	FOUNDATION: Times Changes, Objective	HSA
III	22 Feb 2018	Development of Landscape Ecology; Landscape Ecology Today	HSA
IV	1 Mar 2018	Patches	KAS
V	8 Mar 2018	Corridors and Connectivity	SWI
VI	15 Mar 2018	Mosaics	SWI
VII	22 Mar 2018	Edges and Boundaries	KAS
VIII		Mid-term Exam (UTS)	

References:

1. Principles and Methods in Landscape Ecology → **Almo Farina**
2. Landscape ecology principles in Landscape Architecture and Land use Planning → **Wenche E. Dramstad, James D. Olson, Richard T.T. Forman**
3. International Journals

PPT would be uploaded to BLOG

CONTENT

1. Patch Origins and Change
2. Patch Size
3. Patch Shape
4. Patch Number and Configuration
5. Additional sources

What is Landscape Ecology?

-focuses on (1) the spatial relationships among **landscape elements**, (2) the **flows** of energy, mineral nutrients, and species among the elements, and (3) the ecological **dynamics** of the landscape mosaic through time (Forman 1983)

1. PATCH ORIGINS AND CHANGE ASAL dan PERUBAHAN PATCH

PATCHES

- Obyek yang memiliki sifat seperti **PATCH**, termasuk *quilts* (selimut), **MOSAICS**, tanah, bercak pada Dalmation, dan awan di atas langit.
- Suatu permukaan area yang non-linear yang berbeda penampilannya dari area sekitarnya.
- Bervariasi dalam ukuran, bentuk, tipe, *heterogeneity*, dan *boundary characteristics*.
- Sering dikelilingi oleh **MATRIX**, yaitu area sekitar yang memiliki perbedaan struktur jenis atau komposisinya.

KONSEP DASAR

- E.g. After big fire → the blackened landscape
- Two separate fires had ignited → a single patch was blackened nearby, and an extensive fire had swept the area beyond.
- Unburned area → a little swamp; a clearing and gazed at a patch of grain wave gently in the breeze
- The small burned area was created by a local disturbance, fire.

DISTURBANCE PATCHES PATCH YANG TERGANGGU

- Disturbance of a small area in a MATRIX produced a **DISTURBANCE PATCH**.
- Mud slides, avalanches (longsoran), windstorms, ice storms, herbivore outbreaks, mammal trampling, and many other natural change give rise to **PATCHES**
- **HUMAN ACTIVITIES** also cause **DISTURBANCE PATCHES** → logging in forest, burning in grassland, and strip mining for surface coal or minerals.

SUCCESSION or RECOVERY FROM DISTURBANCE INVOLVES ALL THREE PROCESSES

1. Extinctions
2. Major population size change
3. Immigrations



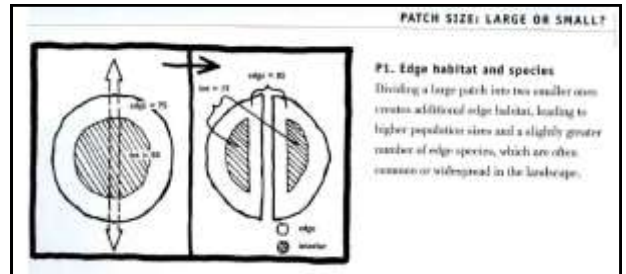
2. PATCH SIZE UKURAN PATCH

UKURAN PATCH

- Land use – what is the **minimum** patch size needed to accomplish a particular objective?
- What is the **optimum** patch size?



- The answers to these questions are crucial to the understanding and management of landscape.
- The primary characteristics considered are ecological: **energy, mineral nutrients, and species**. Others: the ability to operate planting and harvesting machinery, the distance to habitations and market, or topographic variation.

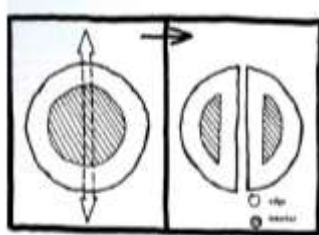


P1. Edge habitat and species
Dividing a large patch into two smaller ones creates additional edge habitat, leading to higher population sizes and a slightly greater number of edge species, which are often common or widespread in the landscape.

P1. Habitat dan Spesies pada Edge

Pemisahan **PATCH BESAR** menjadi dua patches yang lebih kecil membentuk **Habitat Edge** tambahan, menyebabkan jumlah **Edge Species** bertambah. Hal ini kerap dijumpai di setiap lanskap.

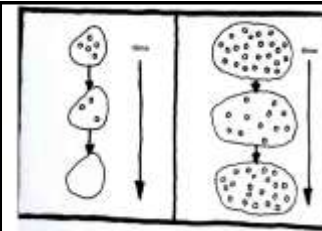
P1 s.d. P8



P2. Interior habitat and species
Dividing a large patch into two smaller ones removes interior habitat, leading to reduced population sizes and numbers of interior species, which are often of conservation importance.

P2. Habitat dan Spesies Interior

Pemisahan **PATCH BESAR** menjadi dua Patches kecil menyebabkan jumlah interior spesies berkurang. Hal ini kerap dijumpai untuk kepentingan konservasi.

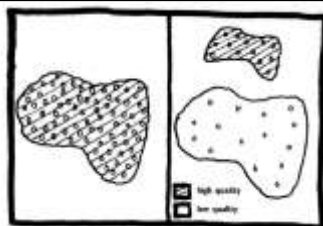


P3. Local extinction probability
A larger patch normally has a larger population size for a given species than a smaller patch, making it less likely that the species (which fluctuates in population size) will go locally extinct in the larger patch.

P3. Peluang Punahnya Spesies Lokal

PATCH BESAR biasanya memiliki ukuran populasi yang lebih besar dibandingkan dengan **PATCH KECIL**. Hal ini menyebabkan kecil kemungkinan spesies lokal untuk punah pada Patch Besar.

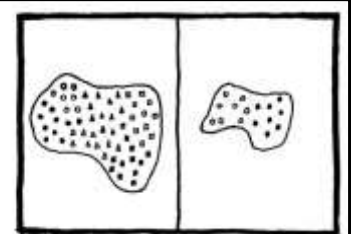
P4. Extinction
The probability of a species becoming locally extinct is greater if a patch is small, or of low habitat quality.



P4. Kepunahan

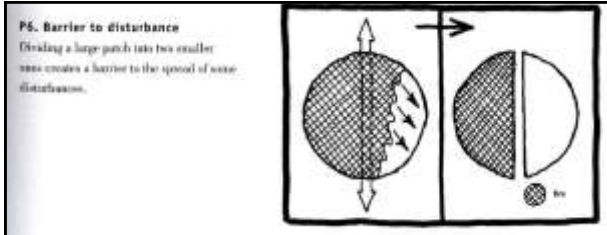
Kepunahan spesies lokal lebih berpeluang pada **PATCH KECIL**, atau pada kualitas habitat yang rendah.

P5. Habitat diversity
A large patch is likely to have more habitats present, and therefore contain a greater number of species than a small patch.



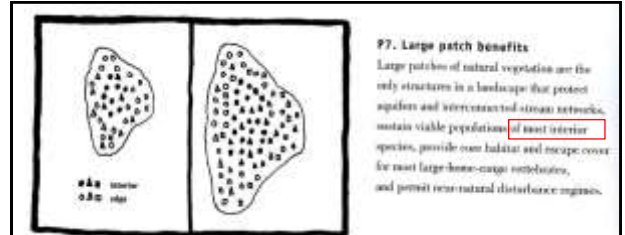
P5. Keragaman Habitat

PATCH BESAR umumnya memiliki keragaman habitat yang lebih tinggi, karenanya memiliki jumlah spesies yang lebih beragam dibandingkan **PATCH KECIL**.



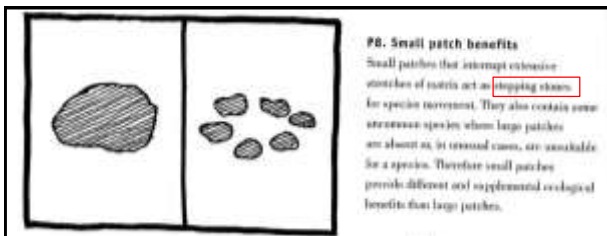
P6. Pembatasan Gangguan

Pembagian **PATCH BESAR** menjadi dua Patch Kecil menyebabkan pembatas yang bisa mencegah penyebaran gangguan.



P7. Keuntungan **PATCH** yang Besar

Patch yang besar dari vegetasi alami merupakan **satu-satunya struktur** yang melindungi *aquifers* dan jaringan sungai, keberlangsungan populasi dari interior species, menyediakan habitat inti, daerah jelajah yang tinggi dan perlindungan terhadap gangguan (*disturbance*).



P8. Keuntungan Patch yang Kecil

Berfungsi sebagai **Stepping Stones** untuk pergerakan spesies.

EFFECT ON SPECIES

DAMPAK TERHADAP SPESIES

- Large islands have **more species** than small islands.
- Mountainous islands have **more species** than flat island of the same size.
- Island with evidence of considerable human disturbance activity often **have fewer species** than those without such activity.
- Relationship between species diversity and island size is not linear, but **CURVILINEAR**.
- The relationship plotted between increasing area and the number of species is called a **SPECIES-AREA CURVE**.

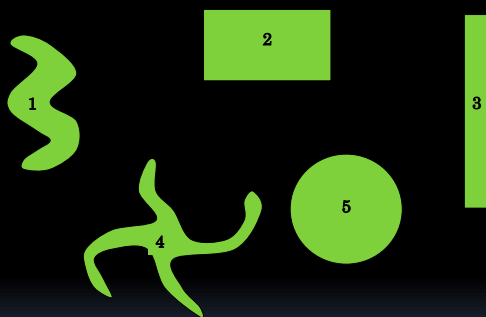
TERRESTRIAL LANDSCAPE VS ISLANDS

- Patches in the **landscape** differ significantly from **islands** surrounded by water.
- Landscape patches may **high average turnover rates**, whereas island are essentially permanent.
- The landscape matrix often has **extremely high heterogeneity**.
- The landscape matrix may be used as a **rest stop** for many species moving between patches, particularly in the limited area of a landscape compared with the extensiveness of oceanic archipelagos.

3. PATCH SHAPE BENTUK PATCH

- Ukuran dan bentuk **PATCH** merupakan atribut penting yang mempengaruhi aliran (**FLUXES**) abiotik dan biotik.
- Di alam umum dijumpai bentuk **REGULAR** dan **IRREGULAR**. Semakin irregular semakin banyak **EDGE** yang tersedia. Hal ini mempunyai implikasi yang sangat besar terhadap penyebaran tanaman dan pergerakan hewan.

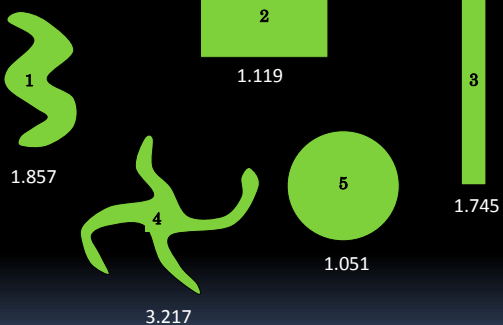
- Dengan menggunakan ratio $L/2\sqrt{A\pi}$, di mana L = keliling patch dan A = luas, dimungkinkan untuk mengevaluasi jumlah dari "edges". Lingkaran mempunyai nilai **Patch Shape=XX** dan menerangkan gambar geometrik dengan ratio minimum antara keliling dan area.



Gambar bentuk dan ukuran patch

NILAI NUMERIK JUMLAH PERIMETER, LUAS DAN EDGE DARI BERBAGAI BENTUK PATCH.

Patch	Perimeter	Area	$L/2\sqrt{A\pi}$
1	659	10,027	1.857
2	277	4,900	1.119
3	373	3,652	1.745
4	1,125	9,736	3.217
5	269	5,222	1.051

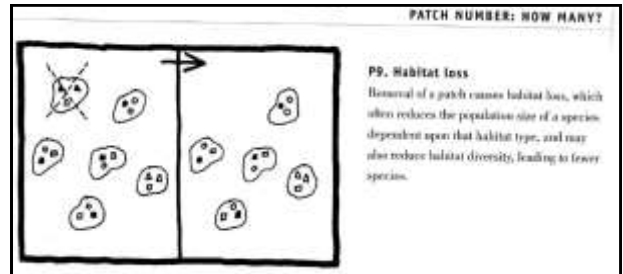


Gambar bentuk dan ukuran patch

4. PATCH NUMBER AND CONFIGURATION JUMLAH DAN KONFIGURASI PATCH

PATCH NUMBER AND CONFIGURATION

- Patches generally do not exist singly but are **numerous** in a landscape.
- A single large patch contains **more species than** several smaller patches.
- More species are found in several patches if the patches are **widely scattered**.

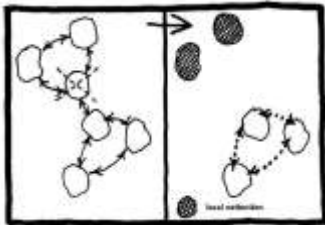


P9. Habitat Loss

Kehilangan patch menyebabkan kehilangan habitat. Pada akhirnya spesies akan berkurang.

P10. Metapopulation dynamics

Removal of a patch reduces the size of a metapopulation (i.e., an interacting population subdivided among different patches), thereby increasing the probability of local within-patch extinctions, slowing down the recolonization process, and reducing stability of the metapopulation.

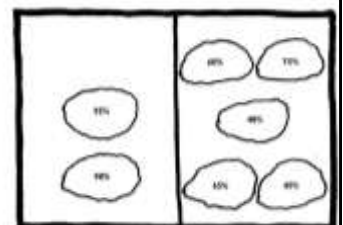


P10. Dinamika Metapopulasi

Kehilangan patch menyebabkan berkurangnya ukuran metapopulasi.

P11. Number of large patches

Where one large patch contains almost all the species for that patch type in the landscape, two large patches may be considered the minimum for maintaining species richness. However, where one patch contains a limited portion of the species pool, up to four or five large patches are probably required.

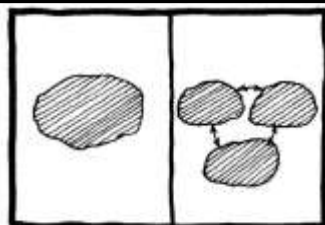


P11. Jumlah dari Patch Besar

Dua cukup, tapi bisa jadi perlu lima tergantung situasi.

P12. Grouped patches as habitat

Some relatively generalist species can, in the absence of a large patch, survive in a number of smaller patches, which although individually inadequate, are together suitable.



P12. Gerombolan Patches sebagai Habitat

Beberapa spesies dapat hidup pada Patch Kecil, namun harus bergerombol.

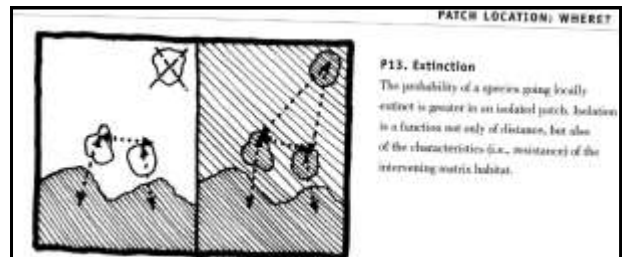
5.
ADDITIONAL SOURCES
TAMBAHAN MENGENAI PATCH

Lanskap dan komponennya (*patches*) dapat diklasifikasikan dengan pendekatan "ANTHROPOCENTRIC", atau dengan pendekatan yang tergantung pada kapasitas pengamatan kita:

1. **STRUCTURAL PATCH**
2. **FUNCTIONAL PATCH**
3. **RESOURCE PATCH**
4. **HABITAT PATCH**
5. **CORRIDOR PATCH**

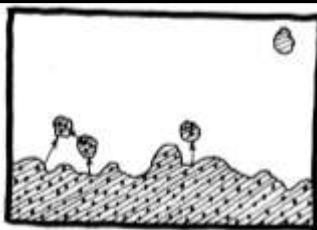
- **Structural patch:** secara umum terdiri dari satu tipe tanah yang dioverlap oleh asosiasi vegetasi
- **Functional patch:** suatu area yang homogen untuk satu fungsi atau satu pendeskripsian fisik, seperti *altitude*, temperatur, kelembaban, penetrasi cahaya.
- **Resource patch:** sebagian besar berhubungan dengan ekologi hewan; suatu lanskap dapat diuraikan sebagai satu kombinasi dari beberapa **resource patches** → bagian dari *home range* hewan (pakan, tempat bersarang tersedia dengan gampang). See Fig. 1.13

- **Habitat patch:** didefinisikan sebagai tipe komunitas tanaman tertentu yang lebih besar daripada *home range* individu.
- **Corridor patch:** sebagai satu bagian dari mosaik lahan yang digunakan oleh organisme untuk pindah/bergerak, menjelajah, menyebar dan migrasi.



P13. Kepunahan

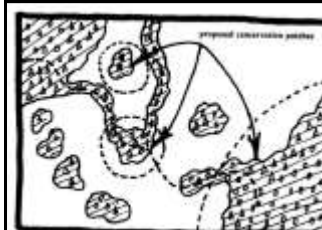
Peluang spesies menjadi punah lebih besar terjadi pada *patch* yang terisolasi. Isolasi tidak hanya dari jarak tetapi juga dari karakteristik dalam *matrix*.



P14. Recolonization
A patch located in close proximity to other patches or the "mainland" will have a higher chance of being re-colonized within a time interval, than a more isolated patch.

P14. Rekolonisasi

Lokasi *patch* yang dekat dengan "mainland" lebih memiliki peluang untuk dikolonisasi daripada *patch* yang terisolasi.



P15. Patch selection for conservation
The selection of patches for conservation should be based on their: 1) contribution to the overall system, i.e., how well the location of a patch relates or links to other patches within the landscape or region; and 2) unusual or distinctive characteristics, e.g., whether a patch has any rare, threatened, or endemic species present.

P15. Pemilihan Patch untuk Konservasi

Pemilihan *patch* untuk konservasi harus didasarkan pada: 1) kontribusi untuk seluruh sistem, i.e. bagaimana hubungan antar *patch* atau hubungan *patches* lainnya di dalam lanskap atau kawasan, 2) karakter yang unik dan tersendiri, i.e. *patch* memiliki spesies langka, terancam punah atau endemik di dalamnya.

TUGAS ANALISIS

1. Berapa nilai *PATCH SHAPE* dari *patches regular* berikut ini?
2. *Patch* nomor berapakah yang lebih tahan terhadap *disturbance*?

Patch No.	Panjang (m)	Lebar (m)
1	150	150
2	200	150
3	300	150
4	500	150
5	1000	150

Jawaban dituliskan pada blog kaswanto.staff.ipb.ac.id
Paling lambat sebelum perkuliahan minggu depan dimulai.

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