# Presentation structure

1. Definition in restoration
2. Mediterranean ecosystems
3. Mediterranean vegetation
4. Restoration in France

- Adaptations

- Nutrient poor soils → roots

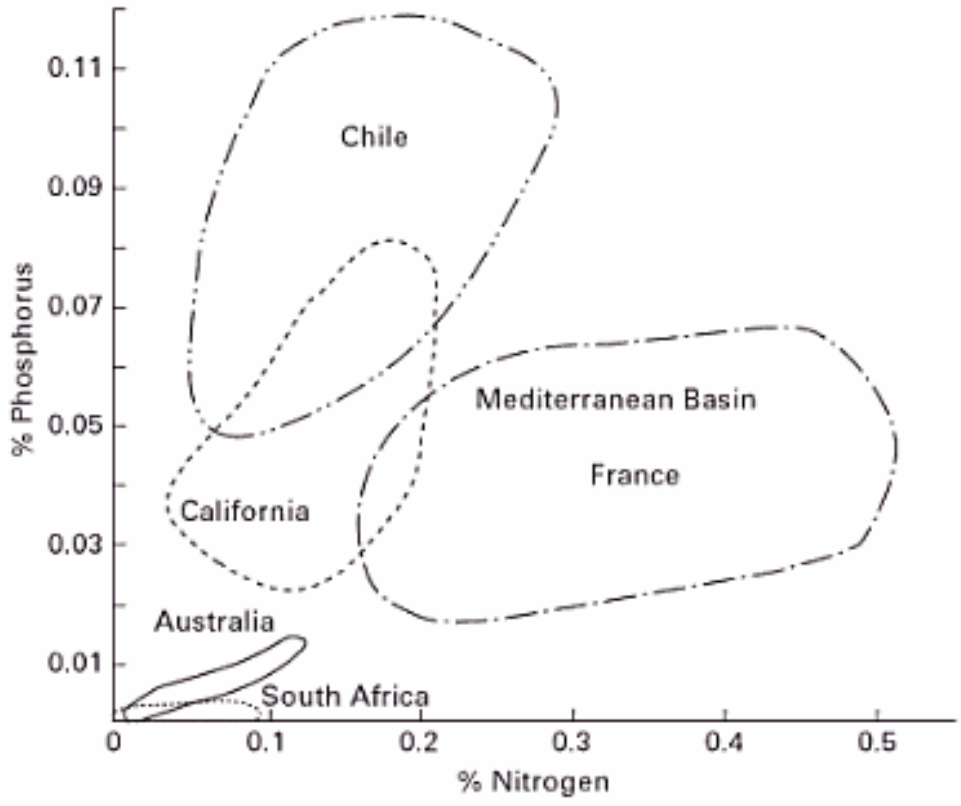



**Fig. 1.5** *Levels of phosphorus and nitrogen in the soils of the five MTC regions. (Redrawn from di Castri 1981.)*

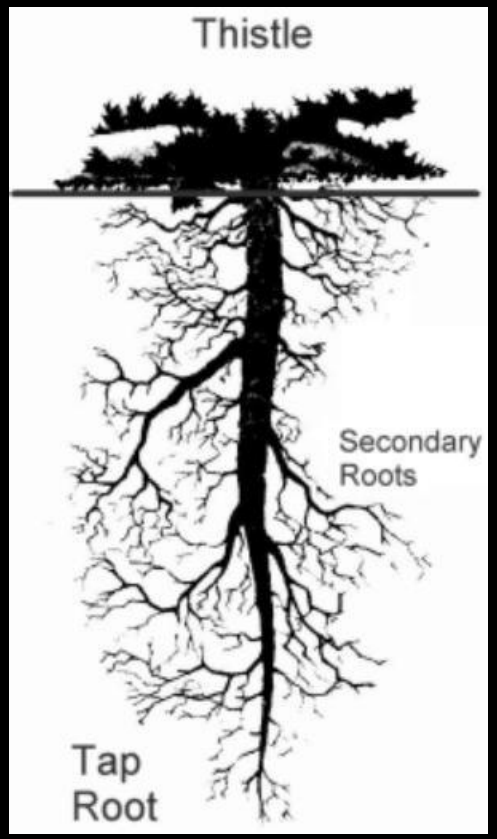
Dallman 1998

- Adaptations

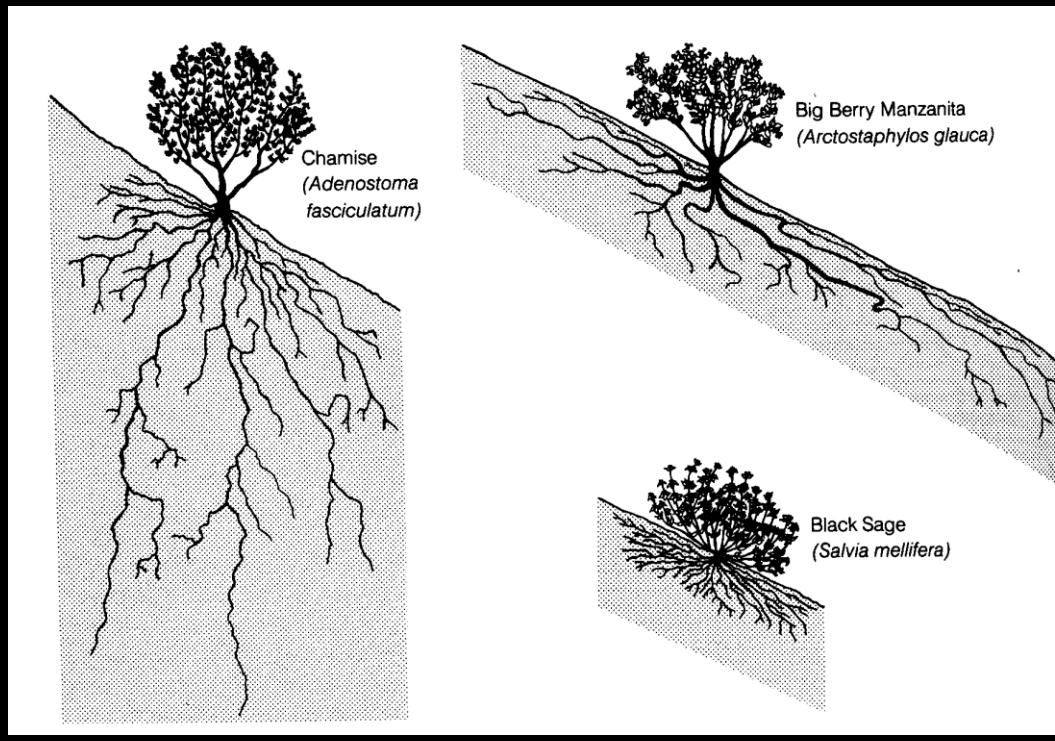
- Roots with two water-seeking strategies

Dallman 1998

Tap roots to access deep water




Shallow wide spreading surface mat designed to intercep infrequent showers or coastal fog



- Adaptations

- Tough, drought-resistant foliage - Sclerophylly

Quercus coccifera

Phillyrea angustifolia

Dallman 1998

- Adaptations

- Foliage protected with:

Hairs: Senecio cineraria

- Adaptations

- Foliage protected with:

Production of Volatile Organic Compounds (VOCs)
→ protection of the photosynthetic apparatus from temperature fluctuations
but also
→allelopathic function (control of seed germination and growth of other plants to avoid competition).
→ defense against pathogens and herbivores.

Rosmarinus officinalis

- Adaptations

- Drought-evading foliage

Leaves drying during summer

Brachypodium retusum

Dallman 1998

- Adaptations

- Drought-evading foliage  Leaves drying during summer

Cistus monspeliensis

Dallman 1998

- Adaptations

- Drought-evading foliage

Tiny leaves, photosynthesis with stem - Microphylly

Coronilla juncea

Dallman 1998

# Water conservation strategies

CHAPARRAL "WATER CONSERVATIONISTS"

SURVIVAL CHARACTERISTICS

| | |
|---|---|
| Small leaves | Less surface area from which water can be lost |
| Thick leaves | Prevent leaves from "overheating". This insulation keeps leaves at a cooler temperature, slowing transpiration. |
| Waxy coating | Serves as a barrier to water loss. |
| Grey green reflecting (dark tops, light undersides) | Reflect light and heat from leaf surface, reduce loss of water. |
| Stomates on undersurface of leaf | Water is lost through pores (stomata) which are located on the lower surface and help keep the leaf cool. |
| Downcurved leaves | Trap water vapor and slow down the rate of water loss ("wet suit" effect). |
| Hairs on leaves | Trap water vapor and slow down the rate of water loss. |
| Hairs on stems | Create air boundary layer, slow down air flow around plant, trap water vapor and slow down rate of water loss. |
| Aromatic oils | Bind water in large molecules to reduce amount of free water in tissue. Reduce water loss. |

- Adaptations - Survival following fire

→All evergreen species in MB are able to resprout after fire or other disturbance from basal stem, buds, roots or rhizomes

Keeley et al. 2012

Quercus coccifera

- Adaptations - Survival following fire

→All evergreen species in MB are able to resprout after fire or other disturbance from basal stem, buds, roots or rhizomes

→ A few have lignotubers (starchy swelling of the root)

Keeley et al. 2012

Arbutus unedo

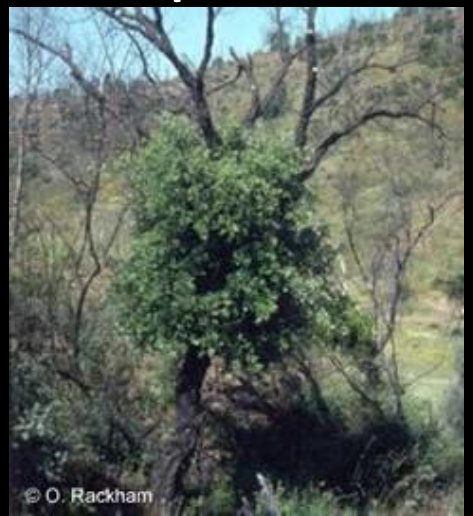
Olea europaea

- Adaptations - Survival following fire

→All evergreen species in MB are able to resprout after fire or other disturbance from basal stem, buds, roots or rhizomes

→ A few have lignotubers (starchy swelling of the root)

→ Some species have specialized stem buds




Quercus suber

Keeley et al. 2012

- Adaptations - Survival following fire

→ Heat-stimulated germination (hard and water impermeable seeds): Cistaceae, Fabaceae

Cistus albidus

Ulex parviflorus

Keeley et al. 2012

- Adaptations - Survival following fire

→ Heat-stimulated germination

→ Smoke simulated germination (water permeable seeds): Lamiaceae, Ericaceae

Lavendula stoechas

Erica multiflora

Keeley et al. 2012

**Table 3.4** Postfire seeding woody genera in MTC crown fire regimes that depend entirely on seeding (obligate seeders) or couple seeding with resprouting (facultative seeders)

| | | Number of species | | | |
|---|---|---|---|---|---|
| | | Obligate seeders | Resprouters (facultative seeders) | Species with populations of both | Source[a] |
| **Mediterranean Basin** | | | | | |
| *Cistus* | Cistaceae | 18 | 0 | 2 | 4 |
| *Erica* | Ericaceae | 1 | 11 | 0 | 4 |
| *Genista* | Fabaceae | 1 | 9 | 0 | 4 |
| *Ulex* | Fabaceae | 1 | 7 | 0 | 4 |
| **California** | | | | | |
| *Arctostaphylos* | Ericaceae | 48 | 4 | 8 | 1 |
| *Ceanothus* | Rhamnaceae | 23 | 14 | 1 | 3 |
| **Chile** | | | | | |
| [none] | | | | | |
| **South Africa** | | | | | |
| *Aspalathus* | Fabaceae | 81 | 11 | 1 | 6 |
| *Cliffortia* | Rosaceae | 60 | 60 | – | [b] |
| *Erica* | Ericaceae | 390 | 27 | 16 | 5 |
| *Leucadendron* | Proteaceae | 27 | 3 | 0 | 6 |
| *Leucospermum* | Proteaceae | 23 | 3 | 0 | 6 |
| *Podalyria* | Fabaceae | 4 | 12 | 2 | 6 |
| *Paranomus* | Proteaceae | 9 | 1 | 0 | 6 |
| *Protea* | Proteaceae | 28 | 15 | 0 | 6 |
| **Southwestern Australia** | | | | | |
| *Adenanthos* | Proteaceae | 15 | 16 | 0 | 8 |
| *Banksia* | Proteaceae | 38 | 20 | 2 | 2 |

Keeley et al. 2012

- Adaptations - Survival following fire

→ Heat-stimulated germination

→ Smoke simulated germination

→ Serotiny (seed release occurs in response to an environmental trigger): *Pinus*

Pinus halepensis

Keeley et al. 2012

- Adaptations - Survival following fire

→ Geophytes (underground storage organ, such as bulbs or rhizomes)

Buds are protected by soil, plant dormant during the fire season

Iris

Ophrys

Keeley et al. 2012

- Adaptations

- Geophytes or bulbs

Buds are protected by soil, plant dormant SUMMER

Iris

Ophrys

Dallman 1998

- Adaptations

- A speedy life cycle: the annuals

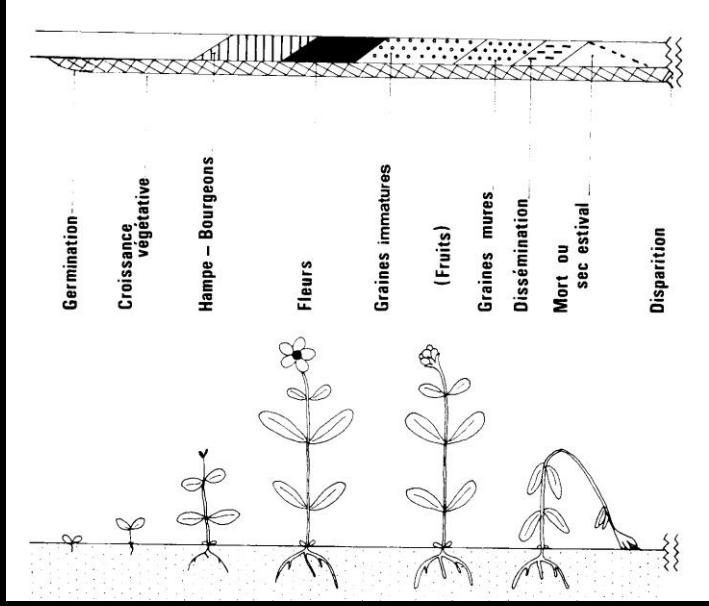
Photo R. Jaunatre

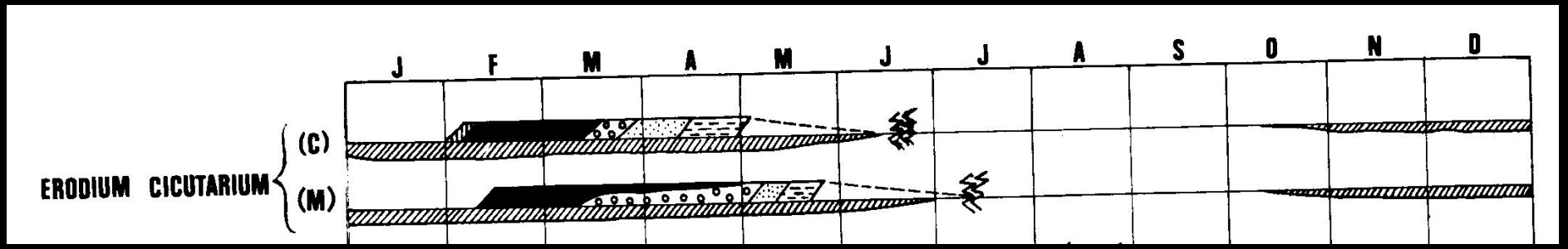
- Adaptations

- A speedy life cycle: the annuals

- Adaptations

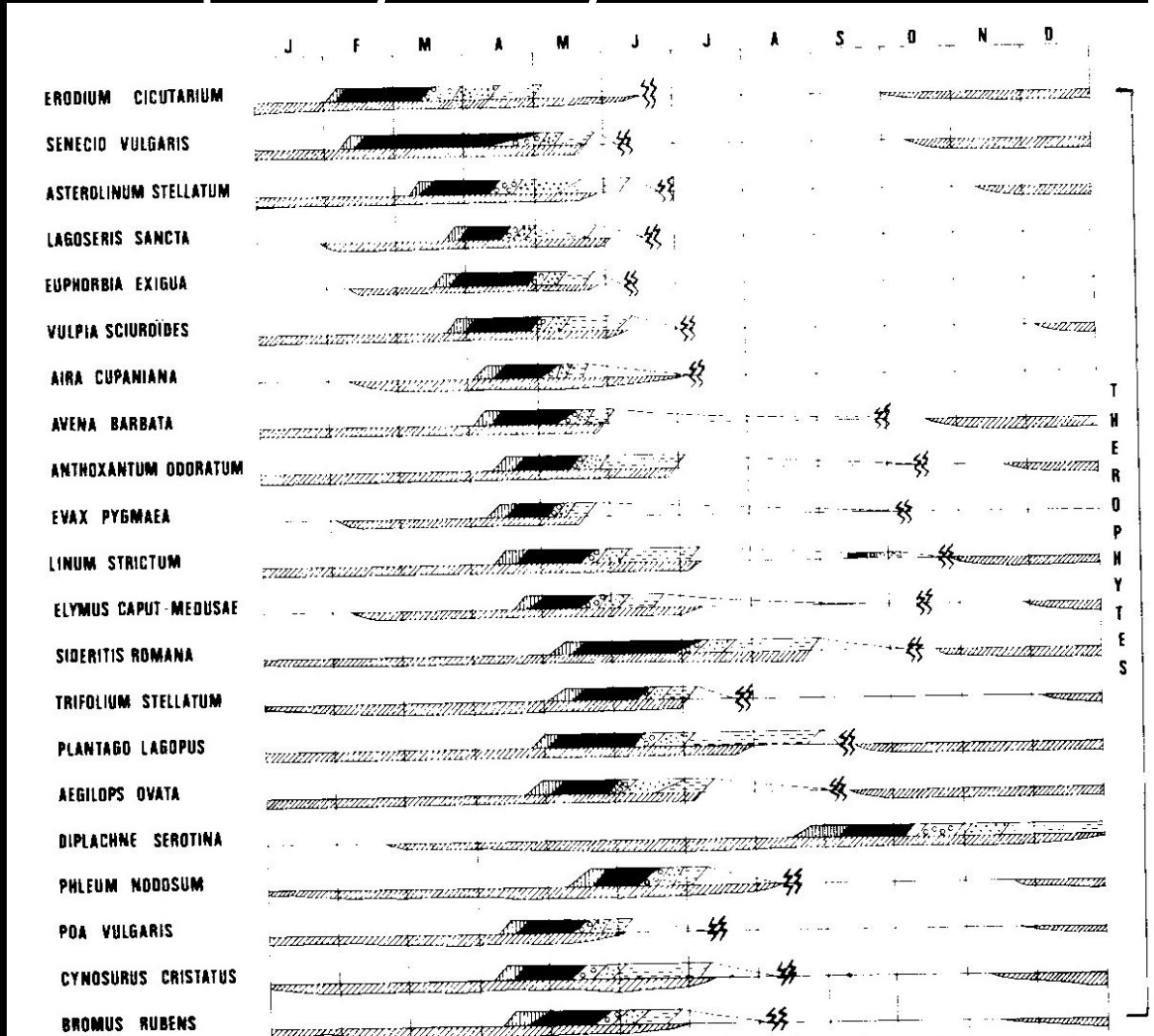
- A speedy life cycle: the annuals

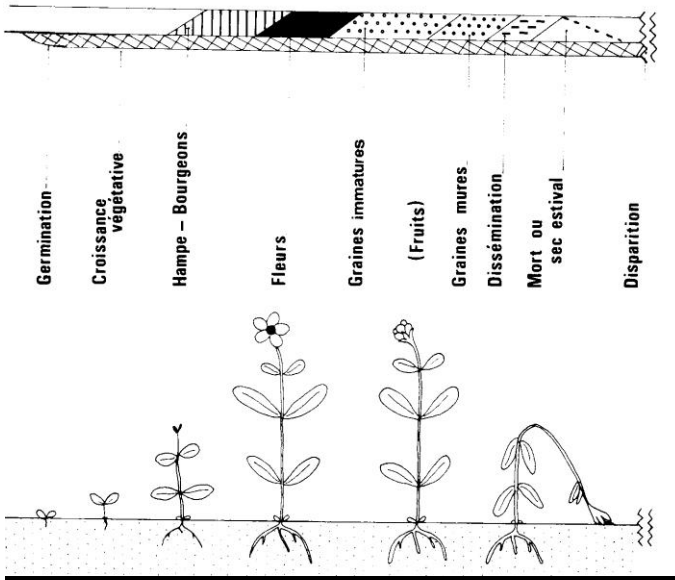


- Adaptations

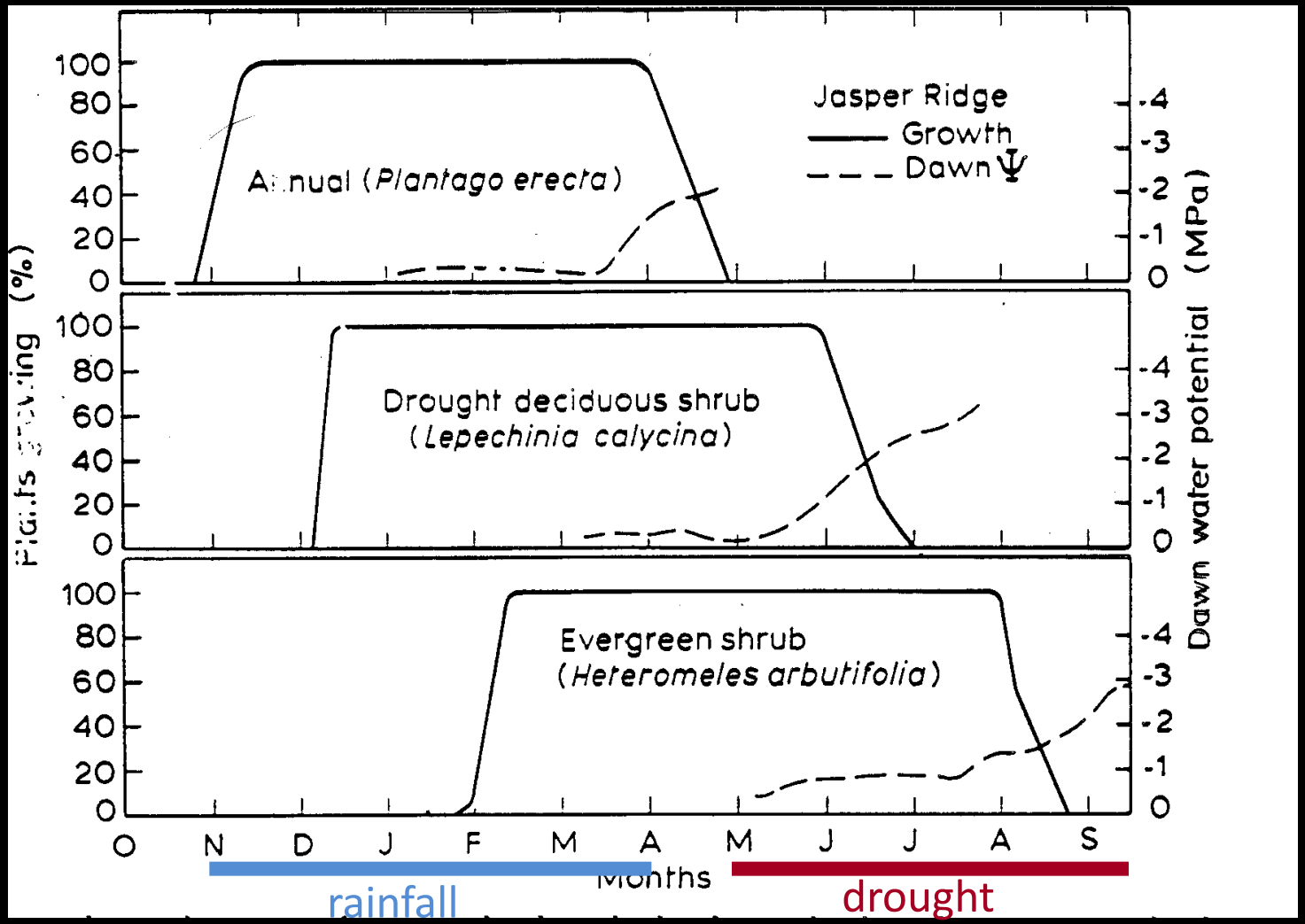
- A speedy life cycle: the annuals



- Adaptations

- Benefits of mild, wet winters



- Human presence

| | *Culture* | *Date* | *Overlap with large native mammals* |
|---|---|---|---|
| Cephalonia (Ionian Islands) | Middle Palaeolithic | c. 50,000 bc | unknown |
| Sardinia | Upper Palaeolithic [or much earlier?] | c. 20,000 bp = c. 21,000 BC | long period |
| Mélos (Cyclades) | Upper Palaeolithic | c. 13,500 BC | no evidence |
| Cyprus | Proto-Neolithic | 10,030 ± 35 bp = 9700–9100 BC | long period |
| Corsica | Pre-Neolithic | 8560 ± 150 bp = 7800–7400 BC | yes |
| Kythnos (Cyclades) | | 7875 ± 500 bp = 7500–6200 BC | no evidence |
| Crete | Pre-pottery Neolithic | 7740 ± 180 bp = 6800–6400 BC | no evidence |
| Balearics | Pre-Neolithic | c. 7000 bp = 5800 BC | long period |
| Malta | Neolithic | c. 6000 bp = 4900 BC | |

Table 5.i. Earliest known evidence of human presence on the islands.

Grove & Rackham 2001

- Human presence

Badan et al., 1995

Henry et al., 2009

- Human presence

*Fig. 1. Shifting sheep grazing on steppe vegetation in La Crau, Provence. Note the exceptionally high stone cover which is a feature of the steppe. The Alpilles form the background. É. Buisson, 2005.*

*Fig. 2. Hay field and irrigation canal in La Crau, Provence. É. Buisson, 2005.*

*Fig. 3. Hay field in La Crau, Provence. E. Buisson, 2005.*

Buisson et al. 2007

- Human presence

*Fig. 1. Cultivation terraces at Lascours, Bouches du Rhône, near Marseille. Two types of permanent crops are seen in close proximity: vines along by the low wall and behind fruit trees including apricot, cherry, almond and olive. Behind are abandoned terraces with fire-prone shrubs such as* Rhus coriaria, Bupleurum fruticosum *and* Ulex parviflorus. *Where terraces cease,* matorral *vegetation dominated by* Q. coccifera *and* Rosmarinus officinalis *grows on shallow rocky soils. P. Roche, 2005.*

*Fig. 2. Cultivation terraces at Lascours showing the following (from foreground to background; see main photograph): at the base of the hill, terraces with olive trees; in the middle, well preserved cultivation terraces in the first stages of abandonment and showing natural colonisation by shrubs. The inset photograph shows old cultivation terraces in the Auriol, Bouches du Rhône, which are in poor condition after several fires. P. Roche, 2005.*

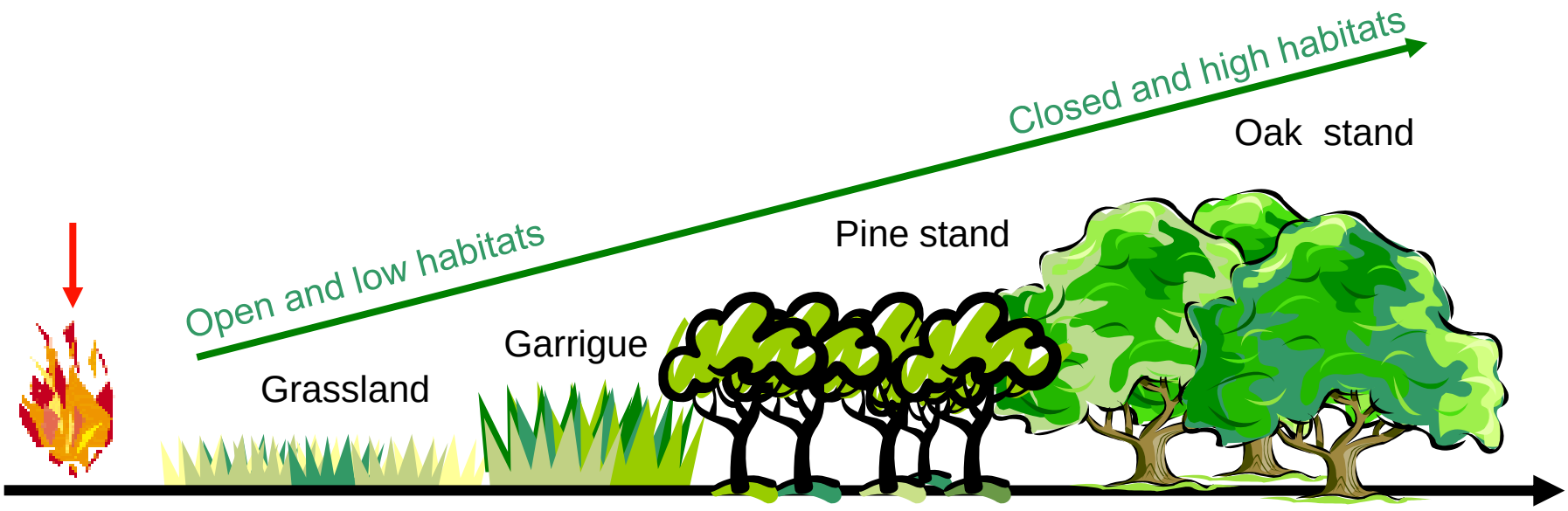
Roche et al. 2007

- Human presence

Bocage = hedgerow

Campagne et al. 2007

# THEORY : SUCCESSIONS OF COMMUNITIES WITH TIME AFTER A SINGLE FIRE



- Human presence

- Human presence

Zonne directement polluée - 12 août 2009 - Photo RNCC / CEEP