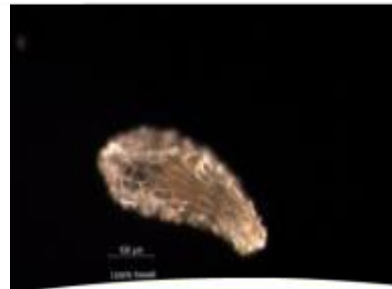


High levels of effective long-distance dispersal may blur ecotypic divergence in a rare terrestrial orchid



An Vanden Broeck, Wouter Van Landuyt,
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inbo



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Fen orchid (*Liparis loeselii*)

Hypothesis



Gene flow by LDD is restricted in fen orchid:
Isolation-by-dispersal limitation

The two different habitats (fens & dune slacks)
contribute to adaptive divergence and restricted
gene flow:
isolation-by-adaptation

Outline

Long-distance seed dispersal (LDD)

Adaptive divergence

two habitats:

dune slack
fen

three scales:

continental
regional
local

A
F
L
P

Outline

Long-distance seed dispersal (LDD)

Adaptive divergence

two habitats:

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Long-distance seed dispersal (LDD)



Fen orchid (*Liparis loeselii*)

pioneer
short-lived
no seedbank
predominantly selfing
wind dispersed
diploid

high dispersal capacity

Long-distance seed dispersal (LDD)

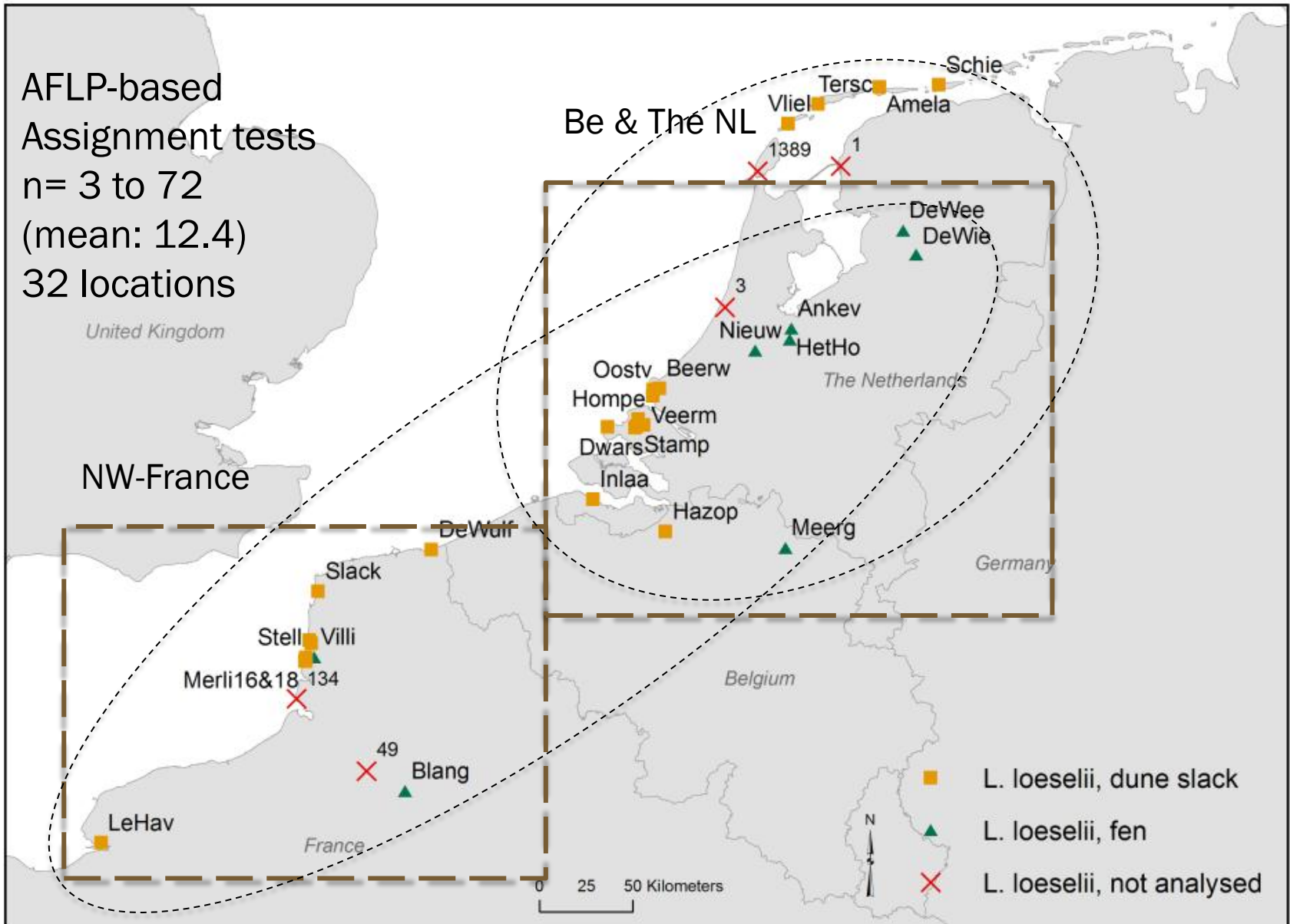
Liparis loeselii seed dispersal



Source: www.youtube.be Kuźnica Wareżyńska sand pit, Zagłębie Dąbrowskie, S Poland, 5 III 2013

LDD : study area, distribution of populations and sampling

AFLP-based
Assignment tests
n= 3 to 72
(mean: 12.4)
32 locations





LDD : the methodology

Individual assignment tests with AFLPOP v.1.1*

re-allocation based on AFLP band frequencies
minimum log-likelihood difference (MLD) of 1
451 polymorphic AFLP loci

*DUCHESNE, P., L. BERNATCHEZ. 2002. AFLPOP : A COMPUTER PROGRAM FOR SIMULATED AND REAL POPULATION ALLOCATION BASED ON AFLP DATA. **MOLECULAR ECOLOGY NOTES**. 3, 380-383.



LDD : the results

	NW-France	Be & The NL
LDD	15.2 *% - 28.2 %	16.5 *% - 30.5 %
Allocation success (P = 0.05)	71.5 % (n > 5; 99.9%)	94.9 %
Distance	Up to 152 km	Up to 220.7 km
Main direction of dispersal	NW & NE	SW
Gene flow between dune & fen pops	Yes	Yes
Effect of the No. of source populations (NWFR + BE & NE) (Wadden islands of BE & NE)	≠ 7 out of 24 (29 %) migrants	≠ 4 out of 61 (6 %) migrants ≠ 3 out of 61 (5 %) **

* Founder effect / ** including Wadden Islands



LDD : remarks

REMARKS

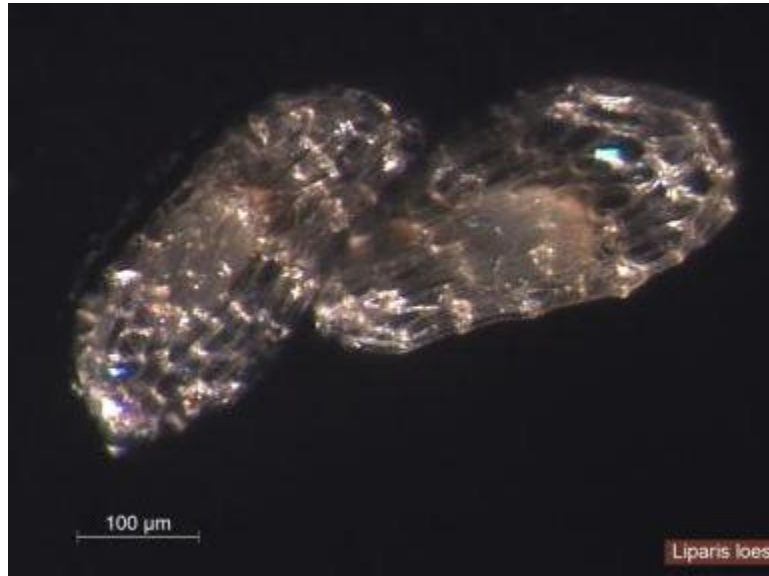
Possibly we missed selfing-lineages

Old populations: dispersal events
may be several generations old



Overestimation of LDD

Actual population connectivity
may be lower



dusty seeds with air spaces

Outline

Long-distance seed dispersal (LDD)

Adaptive divergence

two habitats:

dune slack
fen

three scales:

continental
regional
local

A
F
L
P



Adaptive divergence: two different habitats

wet dune slacks

base-rich fens

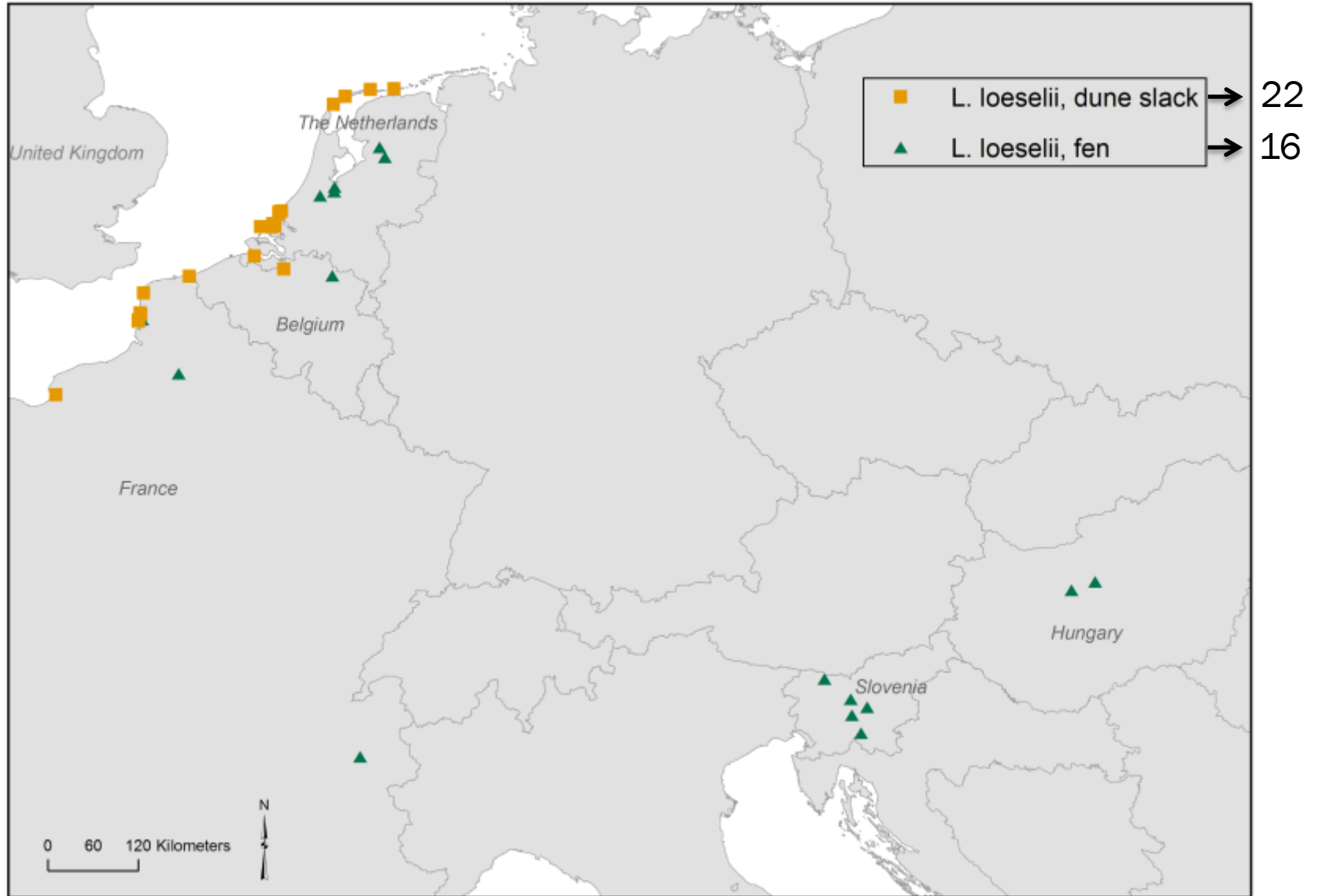


Two varieties

Broad-leaved (var. *ovata*)

narrow-leaved

Adaptive divergence : study area and sampling



Adaptive divergence: the methodology

F_{ST} - outlier loci detection, genome scan

MCHEZA* and BAYESCAN** 2.01, 451 AFLP loci

Overall between-habitat comparisons:

Scale	N_{dune}	N_{fen}
Continental (Europe)	273	117
Regional (NW-Fr, Be, The NL)	273	101
Landscape		
NW-FR	74	33
Be & The NL	199	68

Pairwise population comparisons at the regional scale with BAYESCAN

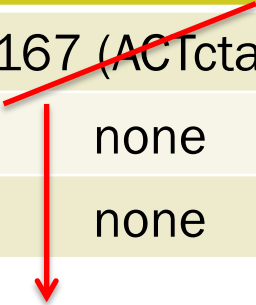
** *Antao T and Beaumont MA (2011) Bioinformatics*
** *Foll, M and OE Gaggiotti (2008) Genetics 180: 977-993*



Adaptive divergence : the results

Overall between-habitat comparisons

Scale	Outlier
Continental (Europe)	ID 167 (ACTcta148)
Regional (NW-Fr, Be, The NL)	none
Landscape	none



ID 167 was also an outlier in 1 pairwise *control* population comparison (fen vs. fen)

Pairwise population comparisons

6 (1.3 %) outlier loci in fen - dune comparisons



One replicated outlier in 3 pairwise dune - fen comparisons

In conclusion

We expected

**restricted gene flow by LDD
strong signals of adaptive divergence**

We found

**high levels of gene flow by LDD
low signals of adaptive divergence at the local
(population) level**

**Dispersal is likely NOT a limiting factor for colonisation
Homogenizing effect of gene flow may erase signals of
divergence**

INBO

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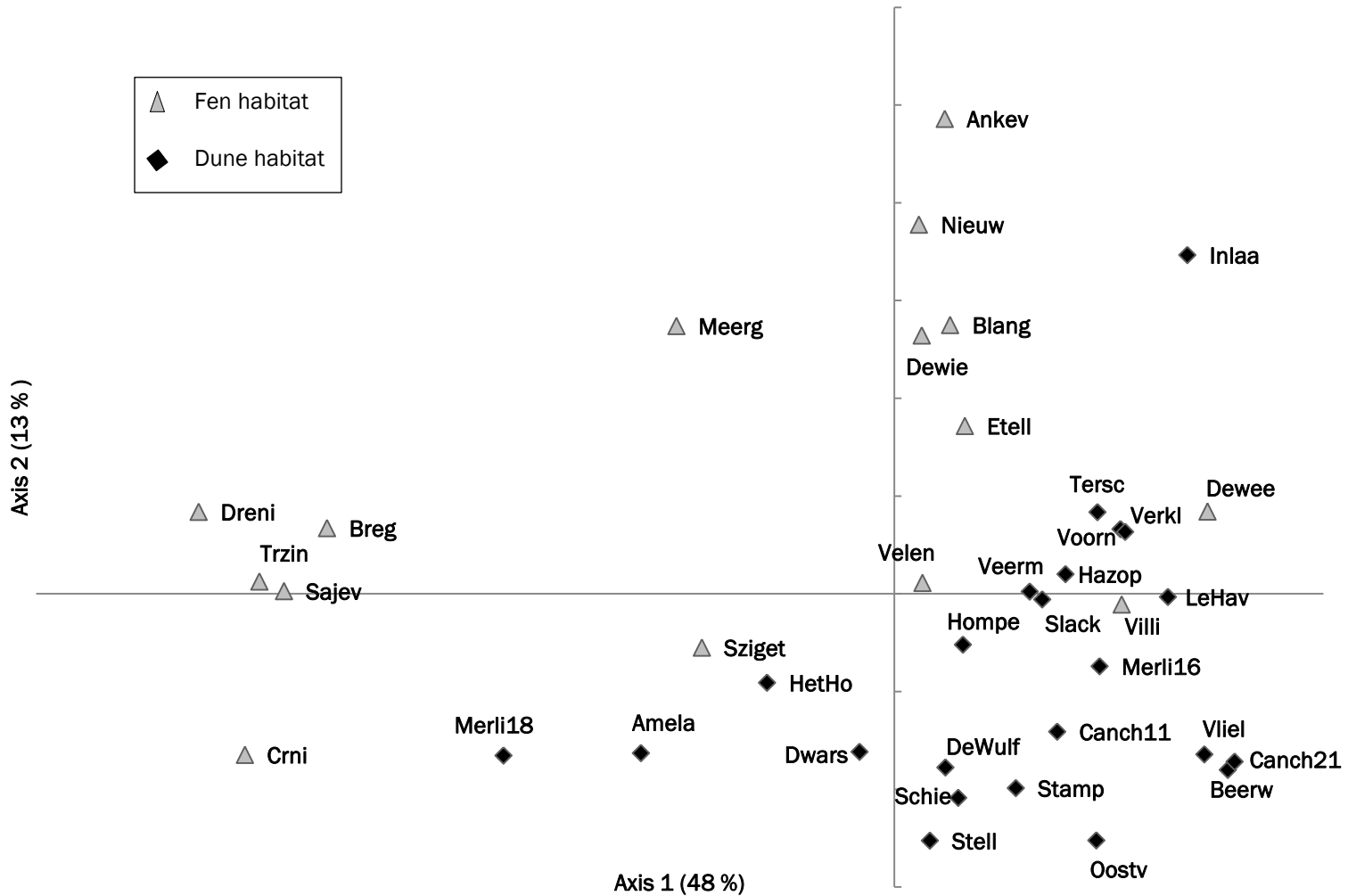
Véronique Bonnet

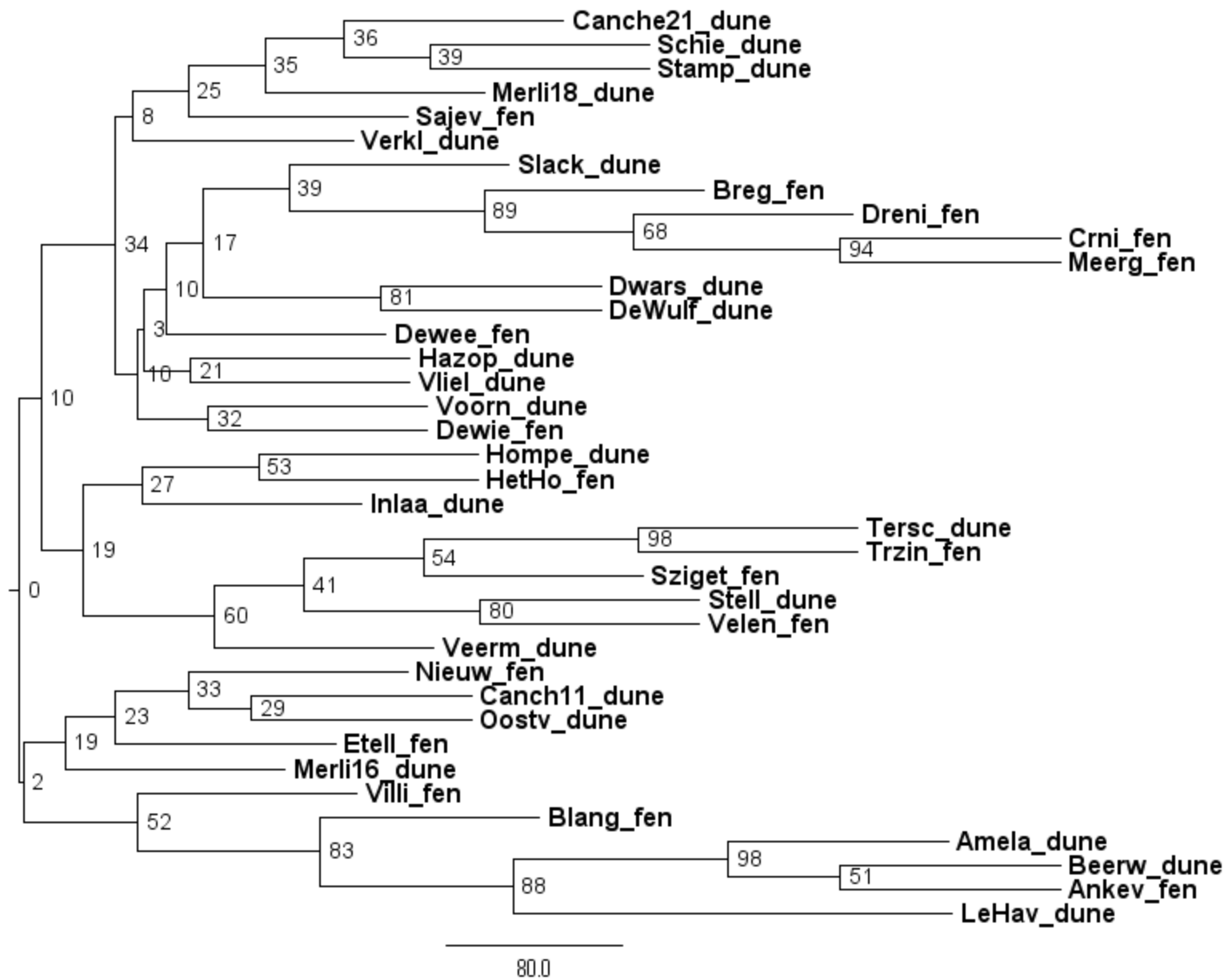
Julien Buchet

nature site managers of

Northwest France







Schie_dune	The Netherlands
Amela_dune	The Netherlands
Tersc_dune	The Netherlands
Viel_dune	The Netherlands
Dewee_fen	The Netherlands
Dewie_fen	The Netherlands
Ankev_fen	The Netherlands
HetHo_fen	The Netherlands
Nieuw_fen	The Netherlands
Beerw_dune	The Netherlands
Oostv_dune	The Netherlands
Voom_dune	The Netherlands
Hompe_dune	The Netherlands
Veerm_dune	The Netherlands
Dwars_dune	The Netherlands
Stamp_dune	The Netherlands
Verkl_dune	The Netherlands
Inlaa_dune	The Netherlands
Hazop_dune	Belgium
Meerg_fen	Belgium
DeWulf_dune	France
Slack_dune	France
Canch11_dune	France
Canch21_dune	France
Merfi16_dune	France
Merfi18_dune	France
Villi_fen	France
Stell_dune	France
Blang_fen	France
LeHav_dune	France
Etel_fen	France
Breg_fen	Slovenia
UmH_fen	Slovenia
Duiv_fen	Slovenia
Saiv_fen	Slovenia
Trzin_fen	Slovenia
Velen_fen	Hungary
Sziget_fen	Hungary