Methods of ordination analysis: an overview
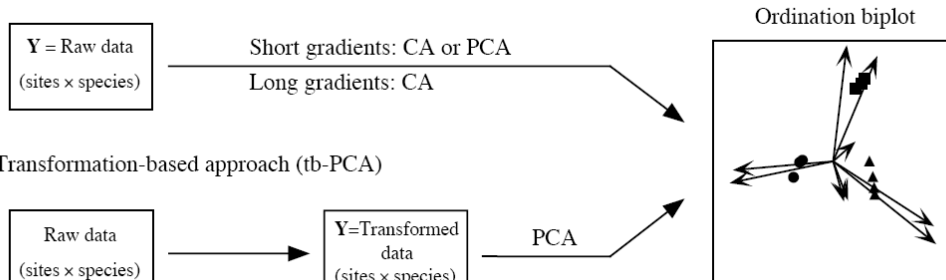
(based on Šmilauer & Lepš 2014, expanded for other methods)
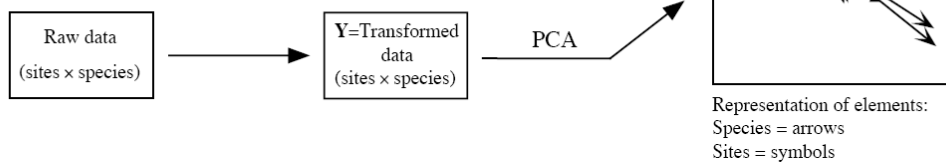
	raw-data-based		transformation-based	distance-based
	linear	*unimodal*		
unconstrained	PCA (Principal Component Analysis)	CA, DCA (Correspondence Analysis, Detrended Correspondence Analysis)	tb-PCA (transformation-based Principal Component Analysis)	PCoA (Principal Coordinate Analysis) NMDS (Non-metric Multidimensional Scaling)
constrained	RDA (Redundancy Analysis)	CCA (Canonical Correspondence Analysis)	tb-RDA (transformation-based Redundancy Analysis)	db-RDA (distance-based Redundancy Analysis)

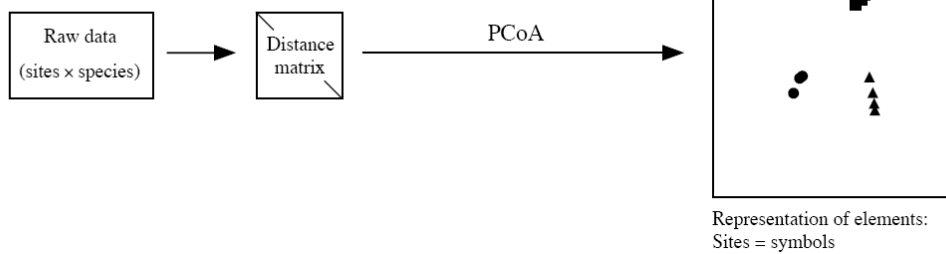# Unconstrained ordination analysis: three alternative approaches

(a) Classical approach

Y = Raw data
(sites × species)

Short gradients: CA or PCA
Long gradients: CA

(b) Transformation-based approach (tb-PCA)

Raw data
(sites × species)

Y=Transformed data
(sites × species)

PCA

Ordination biplot

Representation of elements:
Species = arrows
Sites = symbols

(c) Distance-based approach (PCoA)

Raw data
(sites × species)

Distance matrix

PCoA

Ordination of sites

Representation of elements:
Sites = symbols
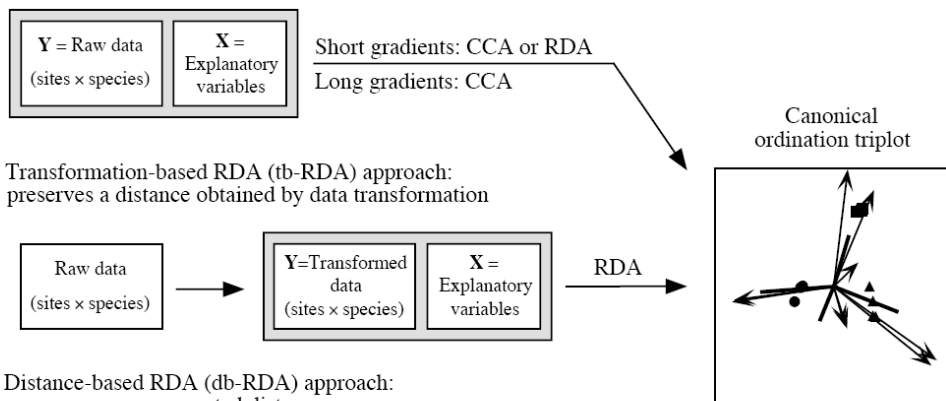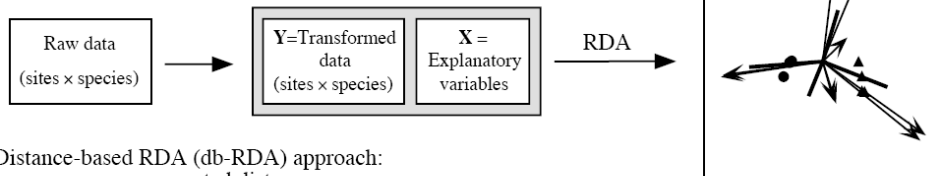
Constrained ordination analysis: three alternative approaches

(a) Classical approach: RDA preserves the Euclidean distance, CCA preserves the chi-square distance

Y = Raw data
(sites × species)

X = Explanatory variables

Short gradients: CCA or RDA
Long gradients: CCA

(b) Transformation-based RDA (tb-RDA) approach:
preserves a distance obtained by data transformation

Raw data
(sites × species)

Y=Transformed data
(sites × species)

X = Explanatory variables

RDA

Canonical ordination triplot

(c) Distance-based RDA (db-RDA) approach:
preserves a pre-computed distance

Raw data
(sites × species)

Distance matrix

PCoA

Y =
(sites × principal coord.)

X = Explanatory variables

RDA

Representation of elements:
Species = arrows
Sites = symbols
Explanatory variables = lines

Legendre & Legendre (2012)