Let's explore the 40 variables (column names) of our analyzed data

Our **analysis** has the dimension

Data	
Analysis	35 obs. of 40 variables

And these are the column names

```
> colnames(Analysis)
 [1] "Out.SubInd"      "SubPrName"      "Observations"   "Studies"        "Sites"           "RR.Shapiro.Sig"
 [7] "RR"              "RR.median"      "RR.var"         "RR.se"          "RR.Quantiles0.25" "PC.Shapiro.Sig"
[13] "PC"              "PC.median"      "PC.se"          "PC.var"         "PC.Quantiles0.25" "Units"
[19] "Model"           "MeanT.Obs"      "MeanT"          "MeanT.se"       "MeanC.Obs"       "MeanC"
[25] "MeanC.se"        "RR.t value"     "RR.Pr(>|t|)"    "RR.Sigma2"      "PC.t value"      "PC.Pr(>|t|)"
[31] "PC.Sigma2"       "RR.pc.se.low"   "RR.pc"          "RR.pc.se.high"  "RR.pc.jen.low"   "RR.pc.jen"
[37] "RR.pc.jen.high"  "PC.pc.se.low"   "PC.pc"          "PC.pc.se.high"
```

Out.SubInd

Since our data is already subset on Land Equivalent Ratio, we do not have many information here. This is our target output.

```
> Analysis$Out.SubInd
 [1] "Land Equivalent Ratio" "Land Equivalent Ratio" "Land Equivalent Ratio" "Land Equivalent Ratio" "Land Equivalent Ratio"
 [6] "Land Equivalent Ratio" "Land Equivalent Ratio" "Land Equivalent Ratio" "Land Equivalent Ratio" "Land Equivalent Ratio"
[11] "Land Equivalent Ratio" "Land Equivalent Ratio" "Land Equivalent Ratio" "Land Equivalent Ratio" "Land Equivalent Ratio"
```

SubPrName

We then have **35** unique subPractice for our selected outcome subindicator. Here are the first 5

```
> unique(Analysis$SubPrName)
 [1] "AgFor Alley (Nfix)-AgFor Prune (Unknown)-AgFor Prune Mulch (Nfix)"
 [2] "AgFor Alley (nonNfix)"
 [3] "AgFor Alley (Nfix)-Inputs N-Seed Improv"
 [4] "AgFor Alley (Nfix)-Inputs K-Inputs N-Inputs P-Irrigation Sprinkers"
 [5] "AgFor Alley (Nfix)-Inputs N"
```

So, our overall objective here is to compile the statistics for each combination of these LER and every subPractice variables.

Observations

We can clearly see that we have 35 rows so, and each row has a number of **observations.**

```
> Analysis$Observations
 [1]  36   9   8  10   2   6 330   9  82  13  20  31   7  14  40  23   2   2   2   2   4   4   4   4   3   6   6  27  16   4   4
[32]  16   8  15  32
```

Studies

This represents the number of studies or publications used. For most of them, only **one** publication has been used

```
> Analysis$Studies
 [1]  1  1  1  1  1  1 25  1  9  2  2  3  1  1  2  2  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1
```

Sites

This just represents the number of geographic locations

```
> Analysis$Sites
 [1]  1  1  1  1  1  1 31  1 10  3  3  4  2  2  3  3  1  1  1  1  1  1  1  1  1  1  1  3  1  1  1  1  1  1  1
```

Response Ratio (RR)

A common effect size metric used to quantify the outcome of experiments for ecological meta-analysis is the response ratio **(RR)**: the log proportional change in the means of a treatment and control group.

$$RR = Log\left(\frac{\text{experimental outcome}}{\text{control outcome}}\right)$$

If $RR > 0 \Rightarrow$ the experimental treatement is better than the control treatment.

In our study, **RR** could either mean **weighted mean** of Response Ration or **weighted median** of Response Ratio

RR.Shapiro.Sig

After applying a Shapiro test to our RRs, the data for the row **Intercrop (nonNfix)** and **Inputs N-Intercrop (Mixed)** are statistically non-normal (*RR.Shapiro.Sig field is <0.05*)

```
> Analysis[,list(SubPrName, Observations, Studies, Sites, RR.Shapiro.Sig)]
                                                         SubPrName Observations Studies Sites RR.Shapiro.Sig
 1:  AgFor Alley (Nfix)-AgFor Prune (Unknown)-AgFor Prune Mulch (Nfix)           36       1     1        0.09467
 2:                                              AgFor Alley (nonNfix)            9       1     1        0.00958
 3:                         AgFor Alley (Nfix)-Inputs N-Seed Improv            8       1     1        0.39344
 4: AgFor Alley (Nfix)-Inputs K-Inputs N-Inputs P-Irrigation Sprinkers           10       1     1        0.84730
 5:                                        AgFor Alley (Nfix)-Inputs N            2       1     1             NA
 6:                                                 AgFor Alley (Nfix)            6       1     1        0.02266
 7:                                                  Intercrop (Mixed)          330      25    31        0.00000
 8:                                      Inputs Urea-Intercrop (Mixed)            9       1     1        0.16208
 9:                                                Intercrop (nonNfix)           82       9    10        0.00008
10:                                                           Inputs P           13       2     3        0.67977
11:                                                  Inputs N-Inputs P           20       2     3        0.68067
12:                                                           Inputs N           31       3     4        0.92929
13:                                         Inputs P-Intercrop (Mixed)            7       1     2        0.88215
14:                                Inputs N-Inputs P-Intercrop (Mixed)           14       1     2        0.11101
15:                                         Inputs N-Intercrop (Mixed)           40       2     3        0.00004
16:                                      Intercrop (Mixed)-Seed Improv           23       2     3        0.23716
17:                                                            MinTill            2       1     1             NA
18:                                                             NoTill            2       1     1             NA
19:                                                  Inputs K-Inputs N            2       1     1             NA
20:                                                  Inputs K-Inputs P            2       1     1             NA
```

Proportional change

```
> Analysis[,list(RR.pc.se.low, RR, RR.pc, RR.pc.se.high, RR.pc.jen.low, RR.pc.jen.high, PC)]
    RR.pc.se.low       RR     RR.pc RR.pc.se.high RR.pc.jen.low RR.pc.jen.high      PC
 1:     14.22614  0.15838  17.16113      20.17154      14.28156       20.22983 1.18444
 2:      2.52946  0.13334  14.26384      27.34121       3.74025       28.84501 1.18889
 3:      0.38072  0.07232   7.49993      15.12404       0.85312       15.66582 1.09250
 4:     76.17542  0.74091 109.78437     149.80489      81.62883      157.53746 2.38200
 5:     56.93889  0.51205  66.87121      77.43212            NA             NA 1.67500
 6:    249.63515  1.27909 259.33683     269.30771     249.89748      269.58479 3.60000
 7:      1.04947  0.07966   8.29188      16.05337       1.43875       16.50046 1.18266
 8:     20.40369  0.25860  29.51157      39.30840      21.04595       40.05150 1.32222
 9:     16.49405  0.34574  41.30352      71.39660      16.75879       71.78612 1.65001
10:     -9.28069 -0.05451  -5.30510      -1.15527      -8.96490       -0.81119 0.95715
11:     -0.61609  0.12252  13.03417      28.55929      -0.45546       28.76708 1.15741
12:      1.86518  0.08012   8.34171      15.23001       1.91562       15.28706 1.09154
13:     39.55799  0.44344  55.80577      73.94518      41.01626       75.76277 1.61667
14:     47.17321  0.45551  57.69774      68.97490      47.77638       69.66742 1.62500
15:     53.85340  0.52782  69.52327      86.78910      54.10053       87.08914 1.73210
16:     22.78197  0.25560  29.12361      35.79280      22.93063       35.95721 1.30119
17:     -1.02312 -0.00602  -0.60061      -0.17629            NA             NA 0.99401
18:     -3.42256 -0.03057  -3.01029      -2.59626            NA             NA 0.96991
19:     48.76350  0.40561  50.02126      51.28966            NA             NA 1.50032
20:     12.99826  0.13758  14.74957      16.52802            NA             NA 1.14777
```

Investigate distributions: **adding percentage results based on median**

```
> Analysis[,list(Observations,RR.pc.jen,RR.pc.median,PC.pc,PC.pc.median)]
   Observations RR.pc.jen RR.pc.median     PC.pc PC.pc.median
1:           36  17.21797    -82.60467  18.44400    19.000000
2:            9  15.61321    -84.73618  18.88900    16.500000
3:            8   8.00583    -87.77824   9.25000    13.000000
4:           10 116.27812    -22.52728 138.20000   117.000000
5:            2  78.77350    -57.47323  67.50000    53.000000
6:            6 259.60643     30.83328 260.00000   270.000000
```

Test of normality of the data

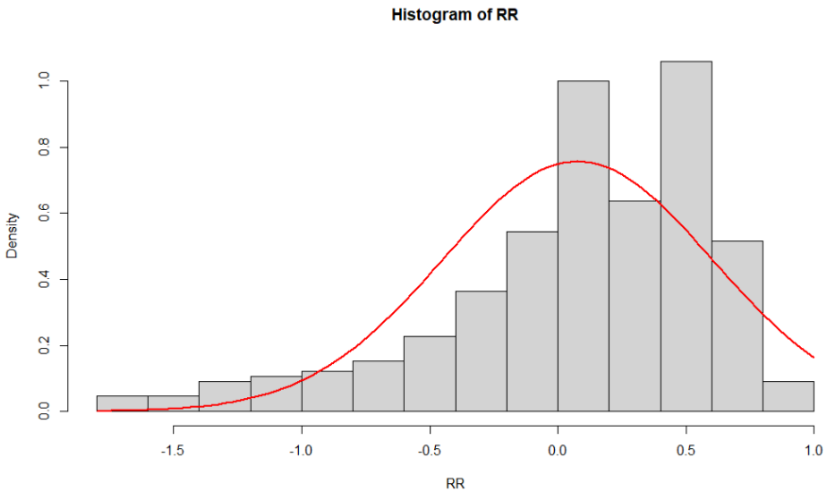
After applying the Shapiro test, we realize that we have many issues with data as (*RR.Shapiro.Sig or PC.Shapiro.Sig <0.05*)

```
> Analysis[,list(Out.SubInd,SubPrName, RR.Shapiro.Sig, PC.Shapiro.Sig)]
               Out.SubInd                                              SubPrName RR.Shapiro.Sig PC.Shapiro.Sig
 1: Land Equivalent Ratio  AgFor Alley (Nfix)-AgFor Prune (Unknown)-AgFor Prune Mulch (Nfix)        0.09467        0.41575
 2: Land Equivalent Ratio                                               AgFor Alley (nonNfix)        0.00958        0.14736
 3: Land Equivalent Ratio                                     AgFor Alley (Nfix)-Inputs N-Seed Improv        0.39344        0.45550
 4: Land Equivalent Ratio AgFor Alley (Nfix)-Inputs K-Inputs N-Inputs P-Irrigation Sprinkers        0.84730        0.78108
 5: Land Equivalent Ratio                                               AgFor Alley (Nfix)-Inputs N             NA             NA
 6: Land Equivalent Ratio                                                      AgFor Alley (Nfix)        0.02266        0.02591
```

Data distribution (with Yields)

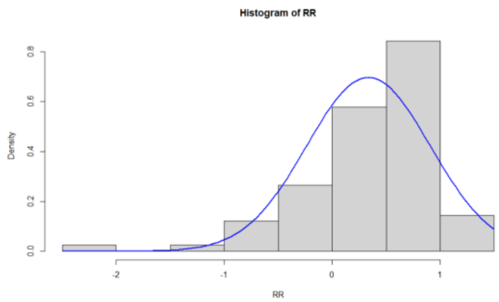
If we take the combination of **Land Equivalent Ratio** and **intercrop (Mixed)** plotting the outcome response ratio and ratio vs a normal curve it shows:

1) The skew in the ratio data is not corrected by the natural log transformation;
2) The response ratio distribution is not normal, it might not probably be good for our study.

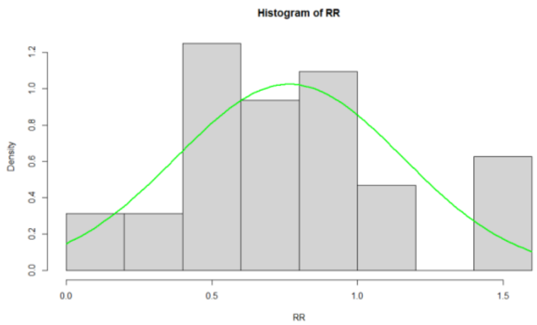


Other combination

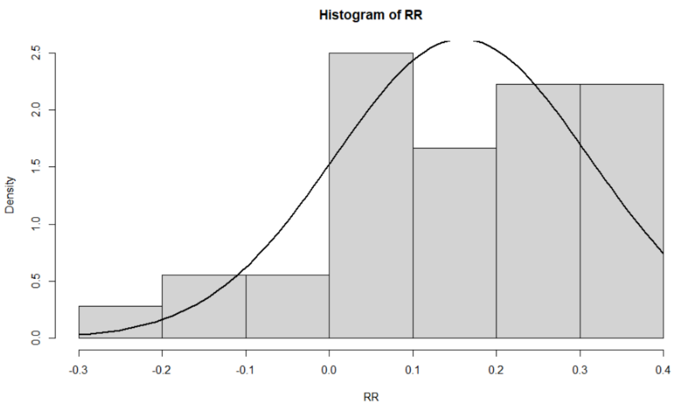
The combination of **Land Equivalent Ratio** and **Intercrop (nonNfix)**



The combination of **Land Equivalent Ratio** and **AgFor Alley (Mixed)**



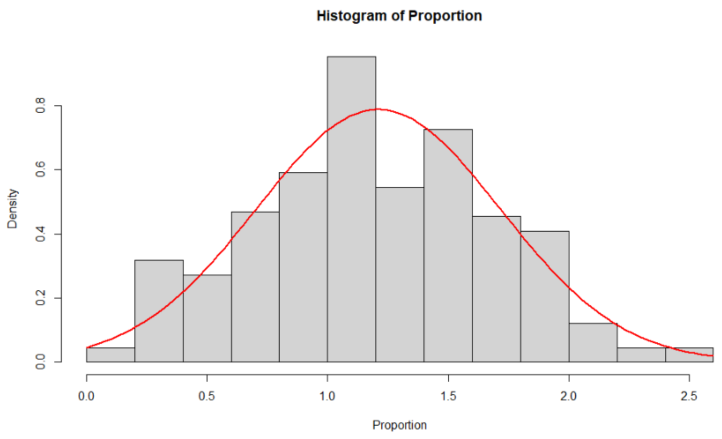
The combination of **LER** and **AgFor Alley (Nfix)-AgFor Prune (Unknown)-AgFor Prune Mulch (Nfix)**



We noticed that **intercrop (Mixed)** has more observations that the others that’s why its response ration distribution curve tend to Normality

Data distribution (with MeanT/MeanC)

The proportion distribution is not quite normal, but it looks corrected



Issue when ordering numerator and denominator

Let’s see how results change when numerator and denominator are swapped

Experimental/control outcome is numerator

Mean

Change estimated from mean of ratios

Change estimated from mean of response ratios

Intercropping VS intercropping rotation

After subsetting our Data_LER on practice names "**Intercropping**", after on "**Crop Rotation-Intercropping**", we have the following dimension

Data_LER_inter	413 obs. of 141 variables
Data_LER_Rot_inter	27 obs. of 141 variables

And the **ERAAnalyse** function gives us the following information

```
> Analysis_1[,list(Out.SubInd,SubPrName, RR, RR.se, RR.pc.se.low, RR.pc, RR.pc.se.high, RR.pc.jen.low, RR.pc.j
en.high)] %>% head
               Out.SubInd           SubPrName      RR   RR.se RR.pc.se.low    RR.pc RR.pc.se.high
1: Land Equivalent Ratio   Intercrop (Mixed) 0.07966 0.06922      1.04947  8.29188      16.05337
2: Land Equivalent Ratio Intercrop (nonNfix) 0.34574 0.19307     16.49405 41.30352      71.39660
   RR.pc.jen.low RR.pc.jen.high
1:       1.43875       16.50046
2:      16.75879       71.78612
```

```
> Analysis_2[,list(Out.SubInd,SubPrName, RR, RR.se, RR.pc.se.low, RR.pc, RR.pc.se.high, RR.pc.jen.low, RR.pc.j
en.high)] %>% head
               Out.SubInd                          SubPrName      RR   RR.se RR.pc.se.low    RR.pc
1: Land Equivalent Ratio Intercrop (Mixed)-Rotation (Mixed) 0.63988 0.09929     71.70196 89.62533
   RR.pc.se.high RR.pc.jen.low RR.pc.jen.high
1:      109.4197      71.87117        109.626
```

MeanT VS no value in MeanT

We don't have any NA value in the MeanT column

```
> Mean_T <- Data_LER$MeanT
> Mean_C <- Data_LER$MeanC
> Mean_T/Mean_C
 [1] 1.0600000 0.8200000 1.0600000 1.0000000 1.1000000 1.2200000 1.2000000 1.0800000 1.2300000 1.4900000
[11] 1.4400000 1.3500000 1.0300000 1.2700000 1.2600000 1.0200000 1.2700000 1.3000000 0.8900000 1.0400000
[21] 1.0000000 1.3200000 1.1900000 1.3800000 0.8100000 1.0900000 1.2900000 1.3300000 1.3700000 1.3800000
[31] 1.0900000 1.1900000 1.1800000 1.1200000 1.3600000 1.4100000 1.1500000 1.3200000 1.4200000 0.5200000
[41] 1.4900000 1.0400000 1.5000000 1.1800000 1.0800000 0.8100000 0.8200000 0.8900000 0.9000000 1.0600000
[51] 1.1300000 1.1400000 1.1800000 1.3200000 1.3700000 1.3800000 1.5300000 1.8200000 1.8200000 2.1700000
```

Comparing intercropping vs monoculture

Since we are able to get the **ratios, response ratios** and finally **yields**, this is a way to compare the two practices

Comparing the LER from two different diversification system

Looking at the diversity from the LER outcome, we have

```
> table(Data_LER$Diversity)

                                                                  Acacia-Roselle 
                                     20                                        2 
                          Acacia-Sesame                           Acacia-Sorghum 
                                      2                                        2 
                        Barley-Fava Bean Black Pepper-Cardamom-Gliricidia sepium 
                                      2                                        3 
Black Pepper-Cardamom-Grevillea robusta           Black Pepper-Gliricidia sepium 
                                      3                                        2 
         Black Pepper-Grevillea robusta                        Butter Bean-Maize 
                                      2                                        4 
                       Calabash-Sorghum                           Cassava-Cowpea 
                                      8                                        8 
                          Cassava-Maize         Cassava-Maize-African Yam Bean 
                                     36                                        6 
                   Cassava-Maize-Cowpea                Cassava-Maize-Groundnut 
                                      4                                        4 
```