In [1]:

```
import pandas as pd
import numpy as np
from sklearn.model_selection import train_test_split, cross_val_sco
import seaborn as sns
from matplotlib import pyplot as plt
%matplotlib inline
from sklearn.decomposition import PCA
import warnings
warnings.filterwarnings('ignore')
```

In [2]:

```
raw_data = pd.read_csv("forestfires.csv")
raw_data.head()
```

Out[2]:

	month	day	FFMC	DMC	DC	ISI	temp	RH	wind	rain	...	monthfeb	monthjan	r
0	mar	fri	86.2	26.2	94.3	5.1	8.2	51	6.7	0.0	...	0	0	
1	oct	tue	90.6	35.4	669.1	6.7	18.0	33	0.9	0.0	...	0	0	
2	oct	sat	90.6	43.7	686.9	6.7	14.6	33	1.3	0.0	...	0	0	
3	mar	fri	91.7	33.3	77.5	9.0	8.3	97	4.0	0.2	...	0	0	
4	mar	sun	89.3	51.3	102.2	9.6	11.4	99	1.8	0.0	...	0	0	

5 rows × 31 columns

In [3]:

```
df = raw_data.copy() #Removing the dummies at this time
df.drop(df.columns[11:30],axis=1,inplace = True)
df.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 517 entries, 0 to 516
Data columns (total 12 columns):
 #   Column         Non-Null Count  Dtype  
---  ------         --------------  -----  
 0   month          517 non-null    object 
 1   day            517 non-null    object 
 2   FFMC           517 non-null    float64
 3   DMC            517 non-null    float64
 4   DC             517 non-null    float64
 5   ISI            517 non-null    float64
 6   temp           517 non-null    float64
 7   RH             517 non-null    int64  
 8   wind           517 non-null    float64
 9   rain           517 non-null    float64
 10  area           517 non-null    float64
 11  size_category  517 non-null    object 
dtypes: float64(8), int64(1), object(3)
memory usage: 48.6+ KB
```

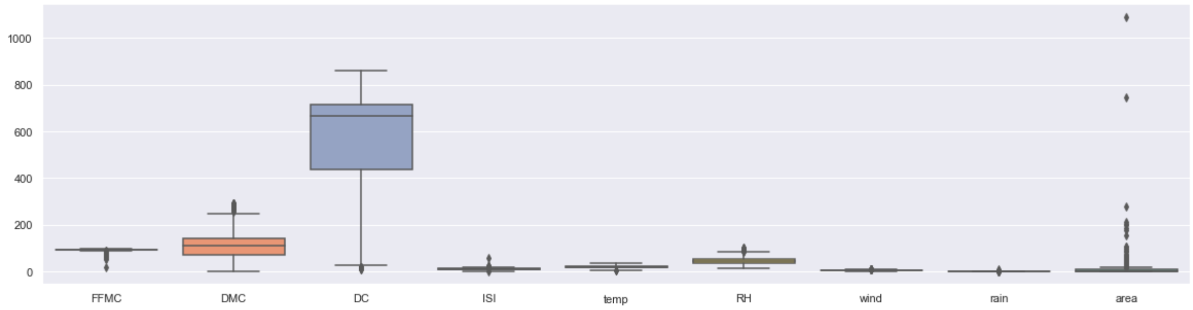
In [4]:
```
df.describe()
```

Out[4]:

	FFMC	DMC	DC	ISI	temp	RH	wind
count	517.000000	517.000000	517.000000	517.000000	517.000000	517.000000	517.000000
mean	90.644681	110.872340	547.940039	9.021663	18.889168	44.288201	4.017602
std	5.520111	64.046482	248.066192	4.559477	5.806625	16.317469	1.791653
min	18.700000	1.100000	7.900000	0.000000	2.200000	15.000000	0.400000
25%	90.200000	68.600000	437.700000	6.500000	15.500000	33.000000	2.700000
50%	91.600000	108.300000	664.200000	8.400000	19.300000	42.000000	4.000000
75%	92.900000	142.400000	713.900000	10.800000	22.800000	53.000000	4.900000
max	96.200000	291.300000	860.600000	56.100000	33.300000	100.000000	9.400000

In [5]:
```
sns.set(rc={'figure.figsize':(20,5)})
sns.boxplot(data=df, orient="v", palette="Set2")
```

Out[5]:
```
<AxesSubplot:>
```



Feature Analysis

In [6]:
```
df.month.value_counts()
```

Out[6]:
```
aug    184
sep    172
mar     54
jul     32
feb     20
jun     17
oct     15
apr      9
dec      9
jan      2
may      2
nov      1
Name: month, dtype: int64
```

In [7]:

```
df.size_category.value_counts()
```

Out[7]:

```
small    378
large    139
Name: size_category, dtype: int64
```

In [8]:

```
from sklearn import preprocessing
label_encoder = preprocessing.LabelEncoder()
df.month= label_encoder.fit_transform(df.month)
df.day= label_encoder.fit_transform(df.day)

df.head()
```

Out[8]:

	month	day	FFMC	DMC	DC	ISI	temp	RH	wind	rain	area	size_category
0	7	0	86.2	26.2	94.3	5.1	8.2	51	6.7	0.0	0.0	small
1	10	5	90.6	35.4	669.1	6.7	18.0	33	0.9	0.0	0.0	small
2	10	2	90.6	43.7	686.9	6.7	14.6	33	1.3	0.0	0.0	small
3	7	0	91.7	33.3	77.5	9.0	8.3	97	4.0	0.2	0.0	small
4	7	3	89.3	51.3	102.2	9.6	11.4	99	1.8	0.0	0.0	small

Removing Bias in the Dataset

In [9]:

```
from imblearn.combine import SMOTETomek
from collections import Counter

resamp = df.copy()

a = resamp.iloc[:,:-1]
b = resamp.iloc[:,-1]

print(Counter(b))

smt = SMOTETomek(sampling_strategy = 'auto')
a, b = smt.fit_resample(a, b)

print(Counter(b)) #removed bias in dataset
```

```
Counter({'small': 378, 'large': 139})
Counter({'small': 370, 'large': 370})
```

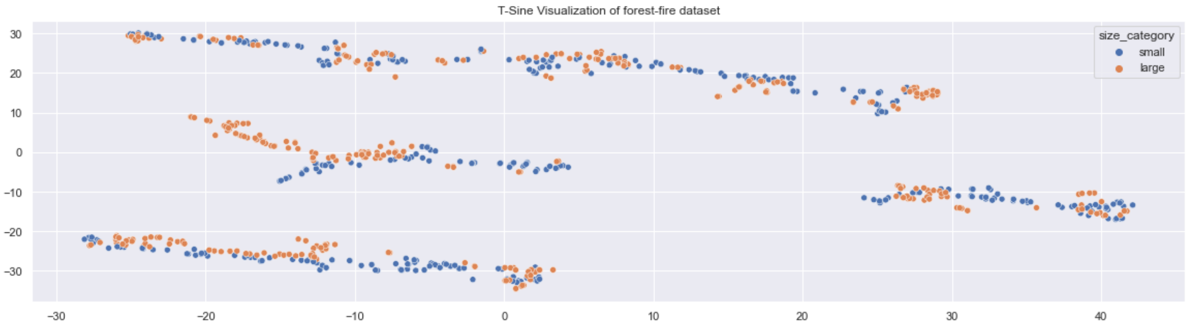
Train | Split dataset

In [10]:
```
X = a
Y = b
X_train, X_test, y_train, y_test = train_test_split(X,Y, test_size
```

In [11]:
```
from sklearn.manifold import TSNE

data_tsne_pca = TSNE(n_components=2).fit_transform(a)
sns.scatterplot(data_tsne_pca[:,0],data_tsne_pca[:,1],hue=b, palett
```

Out[11]:
```
Text(0.5, 1.0, 'T-Sine Visualization of forest-fire dataset')
```



Support Vector Machine Model

In [12]:
```
from sklearn.svm import SVC
model = SVC(kernel='linear', C=1000)
model.fit(X_train, y_train)
```

Out[12]:
```
▾           SVC
SVC(C=1000, kernel='linear')
```

In [16]:
```
from sklearn.metrics import confusion_matrix,classification_report
def report_model(model):
    model_preds = model.predict(X_test)
    print(confusion_matrix(y_test,model_preds))
    print(classification_report(y_test,model_preds))
```

In [17]:
```
report_model(model)
```

```
[[110   0]
 [  0 112]]
              precision    recall  f1-score   support

       large       1.00      1.00      1.00       110
       small       1.00      1.00      1.00       112

    accuracy                           1.00       222
   macro avg       1.00      1.00      1.00       222
weighted avg       1.00      1.00      1.00       222
```

In [18]:
```
model1 = SVC(kernel='poly', C=100)
model1.fit(X_train, y_train)
report_model(model1)
```

```
[[ 94  16]
 [  2 110]]
              precision    recall  f1-score   support

       large       0.98      0.85      0.91       110
       small       0.87      0.98      0.92       112

    accuracy                           0.92       222
   macro avg       0.93      0.92      0.92       222
weighted avg       0.93      0.92      0.92       222
```

In [19]:
```
model2 = SVC(kernel='poly', C=1000)
model2.fit(X_train, y_train)
report_model(model2)
```

```
[[ 97  13]
 [  2 110]]
              precision    recall  f1-score   support

       large       0.98      0.88      0.93       110
       small       0.89      0.98      0.94       112

    accuracy                           0.93       222
   macro avg       0.94      0.93      0.93       222
weighted avg       0.94      0.93      0.93       222
```

In [20]:
```
model3 = SVC(kernel='poly',gamma=0.5, C=1000)
model3.fit(X_train, y_train)
report_model(model3)
```

```
[[106   4]
 [  2 110]]
              precision    recall  f1-score   support

       large       0.98      0.96      0.97       110
       small       0.96      0.98      0.97       112

    accuracy                           0.97       222
   macro avg       0.97      0.97      0.97       222
weighted avg       0.97      0.97      0.97       222
```

GridSearch CV

In [21]:
```
from sklearn.model_selection import GridSearchCV

grid_model = SVC()
param_grid = [{'kernel':['rbf','poly','linear','sigmoid'],'gamma':[
gsv = GridSearchCV(grid_model,param_grid,cv=10)
gsv.fit(X_train,y_train)
```

Out[21]:
```
▸ GridSearchCV
▸ estimator: SVC
      ▸ SVC
```

In [22]:
```
gsv.best_params_ , gsv.best_score_
```

Out[22]:
```
({'C': 0.1, 'gamma': 50, 'kernel': 'linear'}, 0.9923076923076923)
```

Final SVM Model

In [23]:

```
model_fnl = SVC(kernel='linear',gamma=50, C=0.001)
model_fnl.fit(X_train, y_train)
report_model(model_fnl)
```

```
[[109   1]
 [  3 109]]
              precision    recall  f1-score   support

       large       0.97      0.99      0.98       110
       small       0.99      0.97      0.98       112

    accuracy                           0.98       222
   macro avg       0.98      0.98      0.98       222
weighted avg       0.98      0.98      0.98       222
```

In [ ]: